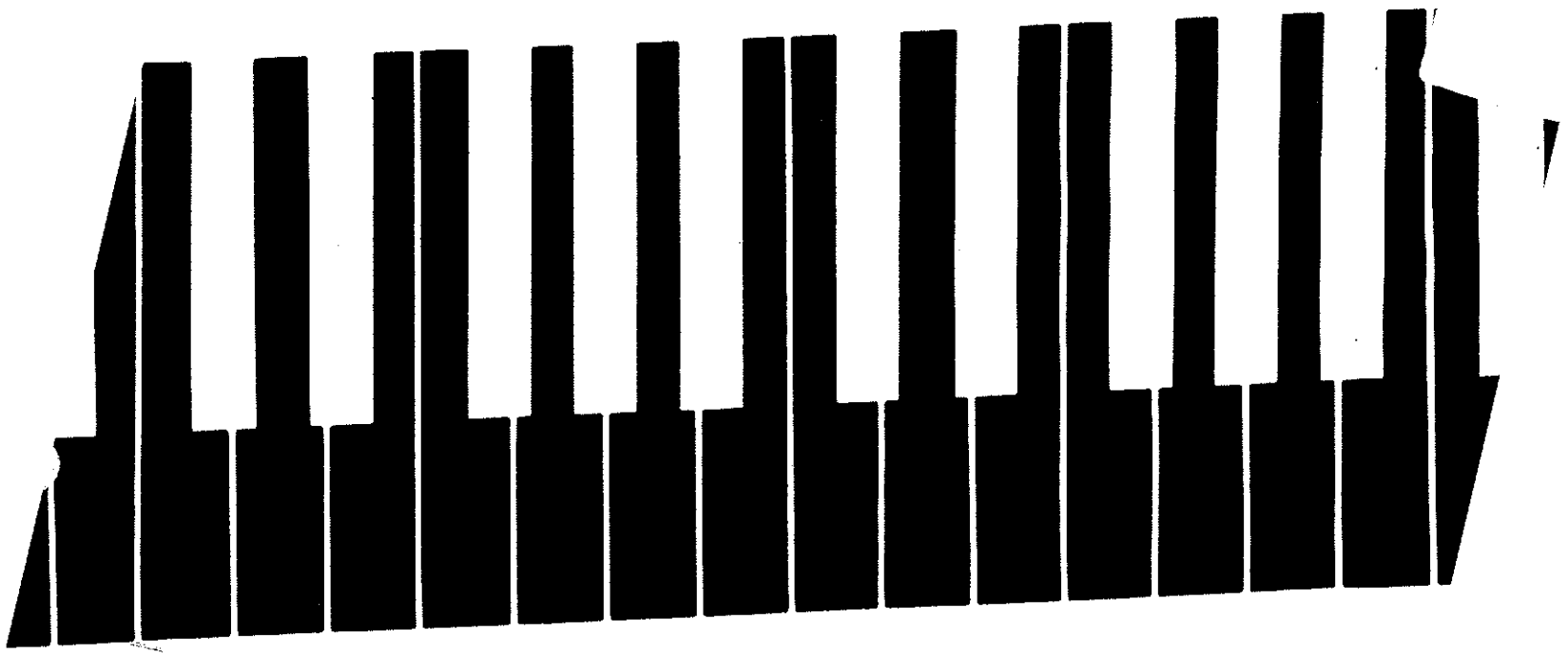
MODEL C300 SERVICE MANUAL



Lowrey organs

PROMENADE

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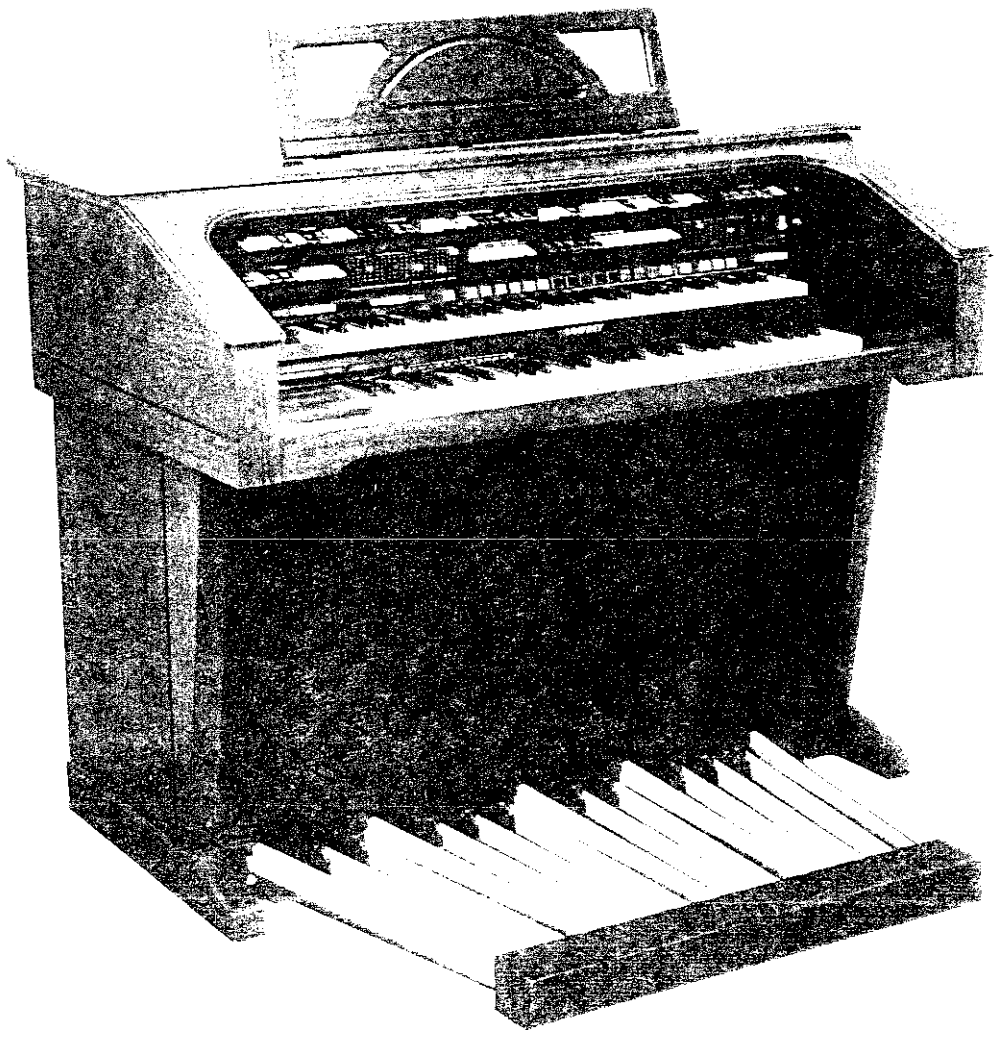
SPECIFICATIONS



GGG *vzA^vrSr* A:T-';?z:7:;Ai'c'?

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2 - **61-n ore keyboards**
1 - 25~iiooe pedal keyboard
4 - Amplifiers —Mam-Leslie-Phase 2-Phase c

2 - 12-a; M BabS **Speakers**
2 - 6x9-rieh Chorus Speakers
2 - 10-iiiv'h Leslie Speaker
1 - 3-ineh Mam Sneaker

BASS

Pedals

Pedal hcocoo
Pedal lb
Pedal 8
Oroh. *v* Pehai

Diaphone 5 6
P^ckd Go e
Per!al **Gm»ai' Go-**

IZevfcoerd

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Gee.if 5 ooo: e

Full
Medium.

GENIE

Magic Geoif ho zoo,;
Chera hmoi
Guitar Struro
Gkoiele So:cos
Strum D ov*o> b: e*

cmoe .-mpeggio
osios'**O i O** -2ouefagr~>
Goioen Harp
hoooieG~oogieBass

PVhlPHOGlC eGTGGGS

Upper
GGlo] ?,
Viola 8
Giohoa 2

2 ov

Violina 4

SPECIFICATIONS

LOWER KEYBOARD

Piano
Guitar
Banjo
Ukulele
Vox Humana 8
Flute 8
Flute 4
Orch. to Lower

Genie Plus Organ

CHORUS

Flute Chorus/Celeste
Leslie Tremolo

PRESETS

Vibes
Vibra Harp
Hawaiian Guitar
Piano
Electric Piano
Harpsichord
Symphonic Wow
Mandolin
Banjo
Orchestral Clarinet
Accordion
Piccolo
Violin
Harmonic 4
Harmonic 2-2/3

UPPER KEYBOARD

Trombone 16
Trumpet 16
English Horn 8
Kinura 8
Vox Celeste 4
Flute 16
Flute 8
Flute 5-1/3
Flute 4
Flute 2-2/3
Flute 2
Flute 1

RHYTHM

Rhythm Start Auto
Rhythm Start

EFFECTS

Sustain
Repeat Percuss
Percuss Long
Wow Attack Slow
Vibrato
AOC

GOLDEN HARP

Up
Down
Up/Down 2
Up/Down 3
Virtuoso
Rhythm Syncopation

FLUTE PRESETS

Flute No. 1
Flute No. 2
Flute No. 3

ORCHESTRAL SYMPHONIZER

Grand Piano
Honky Tonk
Harpsichord
Clavecin
Classic Guitar
Electric Guitar
French Horn
Carillon
Trombone
Post Horn
Trumpet
Trumpet Mute
Saxophone
Krumet Horn
Oboe
Cancel Upper

GENIE SYMPHONIC RHYTHM

Samba
Bosa Nova
Rhumba
Latin Rock
Rock I
Rock II
Rock III
Swing
Dixie
Shuffle
Country
Swing March
March Polka
Swing Waltz
Waltz
Metronome
Snare Cancel
Rhythm Intro

RHYTHM

Bass Drum
Cymbal
Brush
Snare Drum

GENERAL CONTROLS

Orchestral Volume
Harp Speed
Reverb Length
Wow Range
Repeat Speed
Vibrato Depth
Vibrato Speed
Sustain Length
Genie Strum Volume
Genie Arpeggio Volume
Genie Volume
Lower/Flute Volume
Rhythm Speed
Rhythm Balance
Rhythm Volume
String/Vox Lower Volume
String/Upper Volume

GENERAL FEATURES

48 - Major, Minor Seventh and Minor Seventh Chords
Expression Pedal
Golden Harp/Minor Chord Footswitch
Piano Sustain/Glide Footswitch
Master Volume Control on Amplifier
Minimum Volume Control on Amplifier
Auxiliary Input Jack
Tone Cabinet/Cassette Accessory Socket on Amplifier

CIRCUIT DESCRIPTION

SCHEMATIC 1

VIBRATO TONE GENERATORS & DIVIDERS

The tone generators consist of the Master Oscillator Q8, the Top Octave Synthesizers IC2, IC3 and the IC Dividers IC4-IC15. The Master Oscillator creates a 2 MHz signal which is applied to the Top Octave Synthesizers IC2 and IC3. Here the signal is divided to create 13 specific octave frequencies which are applied to the IC Dividers where they are divided in half several times, creating lower octave frequencies. These audio signals are then routed to various diode and audio keying circuits. The Vibrato Oscillator shifts the frequency of the Master Oscillator to create the vibrato effect.

IC1A&B, Q2 VIBRATO DELAY TRIGGER, INVERTER & SWITCHER

Turning on Upper Keyboard preset voices, Vibra Harp, Piccolo, Violin, Orchestral Clarinet or an Orchestral Symphonizer voice, enables IC1A by applying a positive voltage to Pin 2 of ICl A. Pressing an Upper Keyboard keyswitch, applies a positive voltage pulse to Pin 1 of IC1A causing its output to go low which develops a pulse across the .33 uf capacitor. This lowers the voltage on Inverter IC1B causing its output to go high which turns on Q2, momentarily grounding the vibrato oscillator creating the delayed vibrato effect. Pin 1 of IC1A is held high through the 22K resistor for the duration of the pulse across the .33 uf capacitor. Q2 is also switched on to cancel vibrato under the following conditions:

1. **Turning on the Carillon preset; 2. With an Orchestral Symphonizer Piano preset* on, and**
3. **Pressing the Glide switch.**

* **Orchestral Symphonizer Piano preset refers to Grand Piano, Honky Tonk, Harpsichord and Clavecin voices.**

Ql ORCHESTRAL TO LOWER VIBRATO DELAY CANCELLER

With the Orchestral to Lower preset on, a positive voltage is applied to the base of Ql turning it on. This prevents the enabling of ICl A from the Orchestral Symphonizer, cancelling the Vibrato
* **delay effect on the Orchestral Symphonizer voices when they are played from the Lower Keyboard.**

Q3, Q4 VIBRATO OSCILLATOR

The Vibrato Oscillator develops a continual low frequency (6.3 Hz) sine wave of sufficient amplitude to shift the frequency of the Master Oscillator high and low creating a vibrato effect. The oscillator output is applied to the Master Oscillator and the CFG Master Oscillator Q287 via the vibrato tabswitch. It is also applied directly to the Tremolo Drivers Q53 & Q54.

Note: When the Vibrato tabswitch is turned on, the Vibrato Oscillator output bypasses the preset Vibrato circuit and the speed and depth of vibrato are controlled by the Vibrato Controls VR2 & VR3.

Q6 & Q7 VIBRATO ENABLERS & PRESET VIBRATO DEPTH CONTROL

The Hawaiian Guitar, Violin, Piccolo & Orchestral Clarinet voices have a preset vibrato with the Vibrato tab off. Turning on any of these tabs applies a positive voltage to the base of Q6. This turns off Q7 and allows the vibrato signal to pass to the Master Oscillator Q8. The depth of vibrato or the amplitude of the vibrato signal for each voice is controlled by changing the value of resistance to ground at Point G. The cathode of Diode D10 will be considered a ground for the purpose of description, although it is actually slightly negative. Turning on the Hawaiian Guitar tab applies a positive voltage through Diodes D4 & D6, this reverse biases Diodes D5 & D7 causing the amplitude of the vibrato signal to be controlled by the 5.6K resistor to ground. With the Violin or Piccolo tab on, a positive voltage is applied only to the cathode of Diode D7, the path through D5 is forward biased paralleling the 5.6K resistor with the 3.3K resistor, thus reducing the amplitude of the vibrato signal for these voices. Turning on the Orchestral Clarinet leaves both D5 & D7 in a forward biased state - the vibrato signal now 'sees' the parallel combination of a 3.3K, 5.6K & IK resistor which further reduces the vibrato depth for this voice.

Q5 GLIDE SWITCHER

Pressing the glide switch with the Orchestral Symphonizer Piano Presets* off, applies positive voltage to the base of Q5 turning it on. This detunes the Master Oscillator by one semi-tone and creates the glide effect.

* **Orchestral Symphonizer Piano preset refers to Grand Piano, Honky Tonk, Harpsichord and Clavecin voices.**

Q8 MASTER OSCILLATOR

The Master Oscillator Q8 develops a continual 2 MHz signal which is applied to the Top Octave Synthesizers IC2 and IC3, via the Buffers Q9 and Q10.

Q9, Q10 BUFFERS

The buffers act as an isolation stage between the Master Oscillator and the TOS, preventing any change in Master Oscillator frequency due to change in circuit load.

CIRCUIT DESCRIPTION

IC2, IC3 TOP OCTAVE SYNTHESIZERS
IC4-IC15 DIVIDERS

High frequency audio signal is applied to IC2 and IC3 where it is divided simultaneously to produce thirteen specific audio frequency signals. These signals are connected via buffers to upper and lower keyboard keying circuits, and also to IC Dividers IC4-IC15, where they are divided in half several times to produce lower organ tones. The signal outputs are of a particular octave frequency and are shown boxed on Schematic 1. (The letter-number designation within these boxes refer to a specific octave frequency and should not be confused with a keyboard designation.) Buffer transistors provide decoupling between the IC Dividers and diode keying circuits.

SCHEMATIC 2

UPPER KEYBOARD KEYING & CONTROL

UPPER KEYBOARD DIODE KEYING

Pressing an upper keyboard 'keyswitch applies positive voltage via the Cancel Upper circuit to the upper keyboard diode keying circuits. This positive voltage is applied to the anodes of D59 through D63, turning them on and allowing audio signal from the tone generators to pass to their respective diode keying groups. The 68K resistors for each footage are tied together in groups at their output and form the Diode Keying Groups. The positive voltage from each keyswitch also charges a 40 uf sustain capacitor which discharges upon releasing a key and holds diodes D59-63 on. The discharge rate of this capacitor is controlled by the sustain length regulators.

IC18A, IC18B UPPER KEYBOARD KEYDOWN DETECTOR

Pressing an upper keyboard keyswitch applies audio signal from the 5-1/3 and 2-2/3 Keydown Collector Line to Pin 6 of IC18A. IC18A amplifies and inverts the audio signal. D45 and D46 rectify the audio signal into a negative DC voltage. IC18B amplifies and inverts the voltage into a positive voltage which provides the keydown voltage for several circuits.

SUSTAIN LENGTH REGULATORS

Sustain for the Upper Keyboard voices is controlled by regulating the discharge rate of the 40 uf capacitor connected to each keying circuit. This capacitor is charged when holding a keyswitch down; upon releasing the keyswitch the capacitor discharges to the potential on the sustain control line. The remaining charge, if any, is then applied to the anodes of Diodes D59-63 holding them on, allowing audio signal to continue to pass for the duration of discharge time. The discharge time is controlled by Q36 & Q37 as follows: Positive voltage is applied to the base of Q37 by turning on a voice with a preset sustain, or if the sustain upper tab is on, from the Sustain Control VR5. The amplitude of Q37's base voltage is reflected by its emitter and provides the discharge reference for the 40 uf sustain capacitor. The higher the emitter voltage the longer the sustain. Under a no-sustain condition, the base of Q37 is held low causing it to turn on. This applies a positive voltage to the base of Q36, turning it on which holds the sustain line at -4V. Upon releasing a key, any charge on the 40 uf sustain capacitor discharges instantly to -4V. A no-sustain effect is created.

SUSTAIN CANCEL

IC1C, IC1D & Q38 SUSTAIN CANCEL TRIGGER & SWITCHER

Turning on any voice with a diode connected to the sustain cancel enable line applies a positive voltage via Q104 Upper R/S Canceller to Pin 9 of IC1C. This enables gate IClC, allowing it to operate when an upper keyboard keyswitch is pressed. Pressing an upper keyboard key applies a positive pulse to Pin 10 of IClC, causing its output at Pin 8 to go low. This develops a pulse across the .039 capacitor which pulls the input of Inverter IC1D low. The output of IC1D now switches high and turns on Switcher Q38, grounding the base of Q37. This turns on Q36 through Q37 and switches the sustain line to -4V causing any 40 uf capacitor that had been charged by a previously played note to instantly discharge. This creates a one-note or monophonic sustain effect. Also, when the output of IC1D switches high, it holds Pin 10 of IClC high for the duration of the pulse across the .039 capacitor.

SLOW ATTACK DRIVE

Q46 SLOW ATTACK MODULATOR DRIVER

Turning on any voice with a diode connected to the slow attack enable line applies a positive voltage to the Collector of Q46, allowing it to operate when an upper keyboard keyswitch is pressed. Pressing an upper keyboard key applies a positive voltage through a 2.2M resistor and charges a .068 capacitor. The RC time constant of this capacitor and resistor cause a slowly rising voltage to be applied to the base of Q46. This turns on Q46, applying a steadily rising voltage to Pin 5 of IC62 gating the signal through IC62, producing the slow attack effect.

CIRCUIT DESCRIPTION

Q44 SLOW ATTACK DISABLE, PERCUSSION ENABLE SWITCHER

Turning on any upper keyboard percussion voice - Mandolin, Banjo, etc.- applies a positive voltage via the Slow Attack Disable and Percussion Enable Line to the base of Q44, turning it on. When Q44 turns on, it grounds the slow attack keying voltage and disables the Slow Attack Drive circuit. Note that the percussion effect will always override the slow attack effect.

PERCUSSION DRIVE

Turning on any of the following upper keyboard tabs - Mandolin, Banjo, Vibes, Harmonic 4 or Harmonic 2-2/3 - applies a positive voltage via the Slow Attack Disable and Percussion Enable Line to the Percussion Drive circuitry. This enables the percussion drive circuitry allowing it to operate when an upper keyboard keyswitch is played. The following description assumes one of the above-mentioned tabs is on.

NON-REPEAT PERCUSSION DRIVE

Pressing an upper keyboard key momentarily lowers the voltage on the base of Q41, turning it off. When Q41 turns off, a positive voltage pulse is applied to the base of Q42 turning it on, momentarily lowering the voltage on Pin 3 of IC21A. Pin 4 of IC21A switches high applying positive voltage to Q45. Q45 turns on applying positive voltage to Pin 5 of IC62 gating the signal through the Percussion Modulator. The decay time of the percussion pulse is dependent on the discharge time of the .18 uf capacitor at the base of Q45. The discharge path for this capacitor is through Diode D71 and is varied by turning on the Repeat Percuss or Percuss Long tabswitches.

REPEAT PERCUSSION DRIVE

With the Repeat Percussion tab in the on position, the Repeat Oscillator IC21A continuously oscillates. When an upper keyboard key is pressed, the output Pin 4 of IC21A is reset high. This high is applied via contacts of the Repeat Percussion tab and D68 to Pin 3 of IC21A. The 100K resistor and .27 uf capacitor form a time constant. Once the positive voltage at Pin 3 exceeds the high level threshold, Pin 4 switches low. The .27 uf capacitor discharges through D67 and the Repeat Speed Control. When the .27 uf capacitor has discharged below the low level threshold, Pin 4 switches high causing the sequence to repeat itself. The positive pulses applied to Q45 are routed to Pin 5 of IC62 gating the signal through the Percussion Modulator at the speed of the Repeat Oscillator.

WOW DRIVE

Normally the output Pin 10 of IC19A is high. When a positive pulse from the upper keyboard Keydown Detector IC18B occurs, the output of IC19A goes low, which switches the output of IC19B high.

The feedback between IC19A and IC19B makes them a Set/Reset Flip-Flop. At the same time the pulse from IC18B causes the Keydown Reset Q34 to discharge the .22 timing capacitor at the collector of Q35. The timing capacitor then charges through the Ramp Driver Q35 (giving a linear ramp). As the voltage on the capacitor increases, the output Pin 7 of IC20A follows it. When the output of IC20A is .6V higher than the voltage setting of the Range Control VR23 the output Pin 1 of IC20B (normally low) goes high, resetting the Set/Reset Flip/Flop causing the output of IC19B to go low. When IC19B goes low, the timing capacitor discharges through D53 and a 2.2M resistor. As the capacitor discharges, the output of IC20A follows it completing the drive waveform for the wow circuit for Symphonic Wow. The output of IC20A is applied to the Electric Piano and Symphonic Wow filter allowing signal to pass through the filter at the amplitude of the drive waveform.

A positive voltage from the upper keyboard Keydown Detector IC18B is R/C filtered, producing the Electric Piano Drive waveform. This waveform is then routed through Diode D55 to the Symphonic Wow & Electric Piano filter.

16-FOOT R/S TREMOLO DRIVE

ORCHESTRAL CLARINET & ELECTRIC PIANO LAMP DRIVER

Turning on the Orchestral Clarinet or Electric Piano tab applies a positive voltage to the base of Q49, turning it on. When Q49 turns on, it lowers the voltage on the base of Q50 turning it off, applying a positive voltage to the base of Q51 16-foot Preset Voices Lamp Driver. Since Q51 is an emitter follower, its emitter also goes positive, lighting the Lamp in Photocell PI, allowing audio signal to pass to the Main Mixing Preamp IC56B.

VIBES & VIBRA HARP LAMP DRIVE

Turning on the Vibes or Vibra Harp tab applies a positive voltage to the base of Switcher Q47 turning it on. When Q47 turns on, it performs two functions: 1) it turns off Q48, which allows a keydown pulse from the Keydown Detector IC18B to pass through Q49 & Q50 to the base of Q51. This ensures a positive output from Q51 at keydown; 2) Q52 is switched off allowing the output of Q53 to pass to Lamp Driver Q51. Q53 is driven from the vibrato oscillator causing its output to be a low frequency sine wave. This varies the amplitude of Q51's

emitter voltage and gives a tremolo effect to the audio signal passing through PI.

MAIN FLUTE DRIVE

The base of Q54 is normally grounded by a contact of the Leslie Trem switch. This causes Q55 Main Flute Lamp Driver to be biased partially on allowing low frequency Flute signal to pass through Photocell P3 to the Main Mixing Preamp. When the Leslie Trem switch is turned on, the base of Q54 is ungrounded. Q54 is driven from the vibrato oscillator causing its output to be a low frequency sine wave. This varies the amplitude of Q55's emitter voltage and gives a tremolo effect to the low frequency Flute signal passing through P3.

Q56-Q67 SWITCHER DRIVERS

Positive voltage from the tabswitches is applied to the emitters of the switcher drivers. This voltage is greater than the base voltage causing the drivers to saturate. The positive collector output then turns on the FET switcher circuit for the chosen voice allowing audio signal to pass to various voicing circuits.

SCHEMATIC 3

UPPER KEYBOARD 2-2/3-, 4-, 5-1/3-, 8- & 16-FOOT FLUTE FILTERS & SWITCHING

Audio signal from the tone generators is divided into groups called Audio Keying Groups (2-2/3, 5-1/3) and Diode Keying Groups (4, 8 and 16). These groups are filtered individually by the Upper Keyboard Flute Filters for each organ footage 2-2/3, 4, 5-1/3, 8 and 16. After filtering, the signal is collected and amplified before being sent to other voicing circuits where the various organ voices are created. The 4, 8 and 16-foot Groups are combined through 8.2K resistors and routed to Reed/String Collector Amps for use on the Reed and String organ voices. The Flute filter outputs are applied to the Flute Mixing Preamp.

FLUTE FILTERS

The Flute Filters are three pole Low-Pass Filters. There are eight filters for each Flute footage. The output of each filter is inverted from, and should be approximately half the amplitude of, the input.

FET SWITCHERS

All FET Switchers are N-Channel depletion mode devices. They are pinched off by a negative voltage at their gate. Turning on the voice associated with each switcher applies a positive voltage to the gate of the FET cancelling the negative voltage. This allows the FET to conduct, permitting the audio signal from the collector lines to pass to the Flute Mixing Preamp.

IC35C PRESET VOICES COLLECTOR AMP

Audio signal from the 16-foot Preset Voices Collector Line is applied to IC35C where it is amplified and applied to the input of Photocell PI. Turning on the Vibes, Vibra Harp, Orchestral Clarinet or Electric Piano tabs (shown on Schematic 2) enables the Lamp Driver Q51 which lights the lamp in Photocell PI, allowing the signal to pass through PI to the Main Mixing Preamp.

IC35A&B, IC36A 4, 8 AND 16 REED/STRING COLLECTOR AMPS

Audio signal from the 4, 8 and 16-foot Diode Keying Groups is combined and applied to its associated R/S Collector Amp. Here the signal is amplified before being connected to the input of its associated R/S Switcher.

Q71 OUTPHASER SWITCHER

Turning on the Orchestral Clarinet, Hawaiian Guitar or Accordion voice turns on Outphaser Switcher Q71. This combines the 8-foot R/S output with 16-foot R/S audio. This signal is then amplified by the 16-foot collector amp, and routed to filter circuits for the above-mentioned voices.

SCHEMATIC 4

UPPER 2- & 1-FOOT FLUTE FILTERS, LOWER FLUTE FILTERS, R/S COLLECTORS & CHORUS SWITCHING

Audio signal from the tone generators is divided into groups called Diode Keying groups. These groups are filtered individually by the Upper and Lower Keyboard Flute Filters. The Lower Keying Groups are tied together through 8.2K resistors and form the Reed and String signal for the lower keyboard voices. The output from the Magic Chord preamp is connected to the F#2-B2 Lower 8-foot Flute Filter IC45B. The output from the Magic Genie 4-foot TOS is applied to the 4-foot Magic Chord Preamp IC47A. The Flute signal is amplified by the Flute Mixing Preamp and routed to the Leslie Volume Regulator, Chorus Mixing Preamp, Reverb and the Main Channel Flute Low-Pass Filter.

FLUTE FILTERS

The Flute Filters are three-pole low-pass filters. The output of each filter is inverted from, and should be approximately half the amplitude of, the input.

CIRCUIT DESCRIPTION

IC46A FLUTE MIXING PREAMP

All Flute audio from the upper and lower keyboard Flute Filters is applied to IC46A where the signal is amplified. The output signal is applied to the Leslie Volume Regulator IC163, Reverb Driver IC161A, Main Channel Flute Low-Pass Filter IC36B and Flute Chorus Switcher Q87.

IC36B MAIN CHANNEL FLUTE LOW-PASS FILTER

Low frequency Flute audio is allowed to pass through the Flute Low-Pass Filter IC36B and is applied to the Main Flute Photocell P3. A steady DC voltage is applied from the Flute Lamp Driver Q55 to the lamp keeping the photocell resistance low and passing the low frequency audio to the Main Mixing Preamp IC56B. Placing the Leslie Tremolo Switch to on allows the Flute Lamp Driver DC voltage to be modulated by the vibrato. This causes the Photocell Lamp to vary in intensity which gates the low frequency audio through P3 creating a tremolo effect for the Low Frequency Main Channel Flutes.

Q86, Q87 FLUTE CHORUS SWITCHER

When the Flute Chorus tab is off, a negative voltage is applied to the gate of Flute Chorus Switcher Q87 pinching it off, preventing audio from reaching the Chorus Mixing Preamp. Turning on the Flute Chorus tab applies a positive voltage to the base of Chorus Amplitude Switcher Q86. This shunts the 100K resistor to ground, reducing the amplitude of the Flute audio to compensate for the amplification accomplished by the Chorus Mixing Preamps and the Phase Amplifiers. The negative voltage is removed from the gate of Q87 allowing it to conduct. This permits the audio signal to pass to the Chorus Mixing Preamp IC46C.

IC47B, LOWER KEYBOARD 4 R/S COLLECTOR AMP

Audio signal from the 4-foot lower keyboard diode keying groups is combined through 8.2K resistors and applied to the input of the 4-foot lower keyboard R/S Collector Amp. Here this audio signal is amplified and routed to the Lower 4-foot R/S Switcher and to the Vox Humana Filter.

IC48B LOWER KEYBOARD 8 R/S COLLECTOR AMP

Audio signal from the 8-foot lower keyboard diode keying groups is combined through 8.2K resistors and applied to the input of the 8-foot lower keyboard R/S Collector Amp IC48B. Here the signal is amplified and routed to the 8-foot lower keyboard R/S Switcher and to the Vox Humana Filter.

VOX HUMANA FILTERING, SWITCHING

The 4-foot component of the Vox Humana voice is filtered and amplified by IC48A. IC48C filters and amplifies the 8-foot component of the Vox Humana voice. The Vox Humana Mixing Preamp Q88 combines and amplifies the 4- and 8-foot signals. Q89 is an N-Channel FET which is pinched off by a negative voltage at its gate. Turning on the Vox Humana tab removes the negative voltage from the gate of Q89 enabling the Vox Humana signal to pass to the Vox Humana and Lower Symphonic String Mixing Preamp.

SCHEMATIC 5

FLUTE PRESET AND CANCEL UPPER

FLUTE PRESET

FLUTE PRESET LATCHES

Each Flute preset latch consists of a switch, inverter and a "D" Flip-Flop. IC21 is a Hex Schmitt trigger; it has a specific threshold voltage. Pressing a preset switch drops the input of IC21 below its negative threshold resulting in a high at its output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of IC21 and its output remains high until the pushbutton is released. (If a normal inverter were used in this circuit, its output would change with each bounce of the switch. This would clock the input of IC51 and IC52 an indeterminate number of times, making it impossible to determine the end state of IC51 and IC52.) For discussion purposes, references for Flute Preset 1 will be used.

When the output of IC21B goes high, it applies a pulse to the clock input of "D" Flip-Flop IC51A. IC51A is normally in a reset condition - Q low and Q bar high. After clock, both outputs change state and will remain in this condition until 1) the same preset is pressed again applying a pulse to the clock input of IC51A, or 2) pressing a different Flute preset will apply a negative reset pulse (through Diodes D132-D137) to the other two "D" Flip-Flops resetting their outputs and cancelling any preset that was previously on.

Q93-Q98, Q103 & Q104 LAMP DRIVERS, SWITCHERS & R/S CANCEL

FLUTE PRESET

When a preset is active the Q output of the Flute Preset Latch is high and the Q bar output is low. The

high from the Q output is applied to the base of a lamp driver, turning it on and lighting the preset lamp. The high is also applied to a Flute Preset Switcher, turning it on which applies positive voltage to the appropriate Flute Switcher Drivers for that preset.

REED/STRING CANCEL

When a Flute Preset is turned on, positive voltage is applied from a Flute Preset Switcher to the Cancel Enable Q103. Q103 turns on which removes the positive voltage applied to Q105 and cancels the upper Reed/String voices. Q104 is turned off which removes voltage from the upper Reed/String effects.

UPPER CANCEL LATCH

The Cancel Upper Latch consists of a switch, inverter and a D Flip-Flop. IC21E is a Hex Schmitt trigger. It has a specific threshold voltage. Pressing the Cancel Upper switch drops the input of IC21E below its negative threshold, resulting in a high at its output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of IC21E and its output remains high until the pushbutton is released. (If a normal inverter was used in this circuit, its output would change with each bounce of the switch. This would clock the input of IC52B an indeterminate number of times, making it impossible to determine the end state of the Flip-Flops). When the output of IC21E goes high, it applies a pulse to the clock input of IC52B. The Flip-Flops are normally in a set condition - Q high and Q bar low. After clock, the outputs change state and will remain in this condition until the Cancel Upper button is pressed again.

Q99-102 UPPER CANCEL LAMP DRIVER, ENABLE, BUSS DRIVER, AUDIO CANCELLER

When IC52B is clocked, the Q output goes high and turns on Q99, lighting the lamp which is part of the Cancel Upper switch. The Q bar output goes low. If at this time no Orchestral Symphonizer preset is on, the base of Q100 is high and nothing happens. Pressing an Orchestral Symphonizer preset applies a low from IC21F to the base of Q100. With the Q bar output of IC52B low and an Orchestral Symphonizer preset on, the base of Q100 is low turning off Q100. The Upper Keyboard DC keying voltage is removed from the Keyswitch Buss by turning Q101 off. The audio keyed voices (5-1/3-, 2-2/3- and 2-2/3-foot Harmonic) are cancelled by removing positive voltage from their FET switchers by turning on Q102. Under the above conditions, only the Symphonizer preset will be heard.
NOTE: If the Orch to Lower tab had been pressed, positive voltage from the Orch to Lower switch would be applied to Q100, keeping the base of Q100 high. This prevents cancellation of the Upper Keyboard when the Symphonizer is played on the Lower Keyboard.

Q105-113 R/S SWITCHER DISABLE, FLUTE AND HARMONIC 2-2/3-FOOT SWITCHER DRIVERS

Positive voltage from the tabswitches or from the Flute preset circuit is applied to the emitters of the switcher drivers. This voltage is greater than the base voltage causing the drivers to saturate. The positive collector output then turns on the FET switcher circuit for the chosen voice allowing audio signal to pass to various voicing circuits.

SCHEMATIC 6

UPPER AND LOWER SYMPHONIC STRING FILTERS

SYMPHONIC STRINGS

Each footage of Symphonic Strings is filtered in half-octave groups and routed to a collector amp. Here the signal is inverted and amplified. Turning on a Symphonic String tab allows this signal to pass through its associated FET switcher to the Upper or Lower String Volume Control VR11 or VR12. At the output of the volume control, the audio signal is routed to the chorus modulator circuit where it is phase modulated - creating the Symphonic String effect.

FET SWITCHERS

All FET switchers used are N-Channel depletion mode devices (normally conducting). They are pinched off by a negative voltage at their gate. Turning on the voice associated with each switcher applies a positive voltage to the gate of the FET cancelling the negative voltage, allowing them to return to their unbiased state. This permits the audio signal from the collector amps to pass to the chorus modulator circuit.

The positive voltage for the Upper Symphonic String voices is supplied by the switched +6 volt source. When a Flute Preset switch is pressed, the + 6 volts is switched to a negative voltage, cancelling the Upper Symphonic Strings (see Schematic 5).

CIRCUIT DESCRIPTION

SCHEMATIC 7

LOWER DC KEYSWITCHING, TABSWITCHING, GENIE MODULATOR & AUTO RHYTHM START

There are 61 lower DC keyswitches the C1-C4 and C#4-C6 keyswitches having a separate keyswitch on buss. Pressing a C1-C4 keyswitch applies voltage to a diode keying circuit through Diode D189, a 470 ohm resistor and Coil L6. Pressing a C#4-C6 keyswitch applies voltage to a diode keying circuit through a 470 ohm resistor and Coil L7. This voltage biases on Diodes D187 and D188, allowing audio signal to pass to the lower keying groups. These groups are represented by a bold line on Drawing 4. A positive voltage is also applied to the Manual Rhythm Trigger Q337 when a C1-C4 keyswitch is being held.

With the Magic Chord on, the A1-A2 lower DC keyswitches are disabled by grounding the cathodes of Diodes D174-D186. Pressing a key in this range at this time outputs a chord from the Chord Function Generator which is routed to the lower keyboard filtering circuits. Also, when in the chord mode the A2 keyswitch becomes the 7th switch. Pressing the A2 keyswitch at this time applies positive voltage to the 7th Enable Q272 which adds the 7th component to the Magic Chord being played.

RHYTHM START

Placing the Rhythm Start tab in the on position resets Rhythm Start Flip-Flop IC58B. This causes the Q bar output to go high turning on Rhythm Start Switcher Q128, lowering the voltage on the base of the multi-starter which enables the rhythm to start.

AUTO RHYTHM START

Turning on the Auto Start tab (Rhythm Start tab off) performs two functions: 1) the set input of IC58B goes high allowing IC58B to be clocked and 2) the output of the Keydown Detector Q123 is connected to Inverter IC57A. Pressing a lower keyboard keyswitch lowers the voltage on the base of Q123 turning it on. The high level at the collector of Q123 is inverted through IC57A and resets Flip-Flop IC58B. This causes the Q bar output of IC58B to switch high, turning on Switcher Q128 which enables the rhythm to start. If the lower keyboard keys are released and the counter output from IC102 is high, indicating the first half of a rhythm measure, the rhythm will continue to play to the end of that measure. If the counter output is low, this indicates the last half of a rhythm measure and the rhythm will continue to play to the end of the following measure. This is accomplished by the following: To stop the Rhythm Pin 11 of IC57D must make a positive transition, clocking the Q bar output of IC58B low. At this time IC58A is in a reset condition (Q output low), this locks the output of IC57D high. When the lower keyboard keys are released, the output of IC57A switches high. This high level enables IC57C. When Pin 13 of Counter IC102 is high, the output of IC57C switches low. This sets the Q output of IC58A high which is applied to Pin 12 of IC57D. The output of IC57D remains unchanged at this time. The next negative transition of the counter is inverted through IC57B and applied to Pin 13 of IC57D. Both inputs to IC57D are now high and its output goes low. This has no effect on the output state of IC58B. On the next positive transition of the counter, the output of Inverter IC57B switches low. The inputs to IC57D are opposite causing its output to switch high clocking IC58B. This causes the Q bar output Pin 8 of IC58B to go low turning off Switcher Q128 which stops the rhythm. Also, when Pin 8 goes low it resets IC58A. This ensures that IC58A will always be in a reset condition (Q low) at the onset of the Auto Stop sequence.

NOTE: After releasing the keys, the counter must make a negative transition then a positive transition, in that order, before the rhythm shuts off. This causes the turn-off time to vary depending on the state of the counter output when the keys are released.

GENIE MODULATOR

Audio signal from the lower 4- and 8-foot R/S Collector Lines is applied through Switchers Q124 and Q125 to Pin 3 of the Genie Modulator IC55. Signal can only pass through IC55 when a positive voltage is applied to Pin 5. With the rhythm off, Genie Accompaniment Switcher Q127 is off and a positive voltage is routed through the Genie Voices tab to Pin 5 of IC55. This allows audio signal to have a constant path through IC55. Turning on the Genie Voices tab at this time will have no audible effect. With the Rhythm Start tabswitch on, a positive voltage from the Rhythm On Switcher (see Schematic 14) is routed to the base of Q127. This turns Q127 on, which allows positive voltage pulses from the Genie Modulator Driver to pass through D195 and the Genie Voices tab to Pin 5 of IC55. This gates the audio signal through IC55 in time with the Rhythm. Turning on the Genie Voices tab at this time applies a steady positive voltage to Pin 5, giving the capability of playing the lower R/S voices unmodulated when using the rhythm section.

With the Rhythm Auto Start tabswitch on, Q126 Auto Stop Chord Hold Killer is turned on applying a positive voltage to the base of Q127. This positive

voltage turns Q127 on removing voltage from Pin 5 of IC55. When the rhythm is started, pulses from the Genie Modulator Driver will gate audio signal through IC55. When the lower keys are released and the rhythm stops, Pin 5 of IC55 will remain low. This prevents audio from being heard if the Magic Chord and Chord Hold functions were enabled.

The audio signal outputted from the Genie Modulator is applied through the Modulator Follower to the Genie Volume Control. The modulated signal is then routed to the Lower Keyboard Switchers (see Schematic 8).

SCHEMATIC 8

REED/STRING QUALITY CONTROL

Audio signal from the R/S collector amps and Genie volume control is routed to various filtering circuits where the character of each voice is created. The output of each filter circuit is then routed through the Main mixing preamp to reverb and main volume regulator circuits. The Trumpet filter is used to filter Orchestral Clarinet and Hawaiian Guitar audio signal. The Hawaiian Guitar gain switcher lowers the amplitude of the input signal to the Trumpet Amp IC63B when the Hawaiian Guitar tab is on.

IC62 & IC63A PERCUSSION & SLOW ATTACK MODULATOR & VOLTAGE FOLLOWER

Violin, Accordion and Piccolo are the Slow Attack voices of the organ. Turning on any of these tabs applies signal to the input (Pin 3) of IC62. Signal is gated through IC62 when positive voltage is applied to Pin 5 from the Slow Attack Modulator Driver Q46. This creates the Slow Attack effects for these voices.

Banjo, Mandolin, Harmonic 4 and Harmonic 2-2/3 are the Percussion voices of the organ. Turning on any of these tabs applies signal to the input (Pin 3, Pin 2 for the Banjo voice) of IC62. Signal is gated through IC62 when positive voltage is applied from the Percussion Driver Q45 to Pin 5 of IC62. This creates the Percussion effect for these voices.

The signal is then applied to the input of IC63A where it is transformed into a low impedance signal before being applied to the Main Mixing Preamp IC56B.

IC66, IC67, Q149, Q150 ELECTRIC PIANO & SYMPHONIC WOW FILTER & EMITTER FOLLOWERS

This circuit is a State Variable Filter that acts in conjunction with the 800P capacitors to form an RC low pass filter. Signal from the R/S 16 signal line is gated through the filter at the amplitude of the drive waveform applied to Pin 5 of IC66 and IC67. The output is a low impedance signal that is routed to the Main Mixing Preamp when the Electric Piano tab is turned on. Turning on the Symphonic Wow tab routes the signal to the Chorus Mixing Preamp.

SCHEMATIC 9

UPPER ORCHESTRAL SYMPHONIZER & 16-FOOT LOW OCTAVE KEYING

The purpose of the low-octave keying circuits is to provide the octave frequencies for the 12 lowest 16-foot notes. If two or more low octave notes are pressed, only the lowest note will be heard.

16-FOOT LOW OCTAVE KEYER

Pressing a 16-foot low octave keyswitch applies audio signal to Divider IC70 where the frequency is divided to create the 16-foot pitch. The audio signal is applied to Q157. Diodes D235 and D236 rectify the audio signal into a low level. This low causes Q158 to turn on, forward biasing D237 and D238 and applying audio signal to the 16-foot Flute Filter.
NOTE: If the Cancel Upper switch and an Orch.Symp.Preset were on, the switched +24 volt supply would be low preventing the 16-foot Flute from being keyed.

ORCHESTRAL SYMPHONIZER LOW OCTAVE KEYING

Pressing an upper keyboard low octave keyswitch with an orchestral symphonizer preset on applies positive voltage to the base of Q155 through either the Brass or Piano/Guitar keying line. Only one of these keying lines can be enabled at any one time. The amplitude of keying voltage through the Brass keying line is such that the .33 uf capacitor charges relatively slow. This produces a steadily rising voltage at the emitter of Q155, causing the 330K resistor and the .0056 uf capacitor to charge to a changing reference. On initial keydown, this will cause the output of Q156 to vary from a wide pulse width of small amplitude to a narrow pulse width of higher amplitude and creates the breathy keydown effect for the Brass voices. After the emitter of Q155 reaches its maximum DC level, the output of Q156 will be a pulse waveform with approximately a 10% duty cycle at the frequency of the input signal. The output of Q156 then passes through diode D232 to the Orchestral Symphonizer Pulse Keyer Filter. Releasing the key causes any remaining capacitor charge to discharge through D230 and a 120K resistor to ground. The keying voltage through the Piano/Guitar keying line is of a higher amplitude and is applied as a pulse to the base of Q155. This causes the emitter of Q155 to go to its maximum voltage at keydown creating a positive pulse at the collector of

Q156. This pulse is routed through D231 to the strike tone amp and creates the percussive keydown effect fo the Piano and Guitar presets. Also the emitter voltage from Q155 biases on Diode D233 allowing audio signal to pass to the sawtooth filtering groups. If the key is held down, the decay time of this pulse is determined by voltage on the snub line through Diode D225. After the snubbing, the remaining capacitor voltage holds on Q155 for the duration of its discharge time. If the key is released before the decay is complete, the capacitor discharges through Diode D230 and a 120K resistor to ground. (This discharge path is blocked as long as a key is being held because of the reverse bias condition of D230.) NOTE: If an Orchestral Piano preset is on, the glide switch becomes a sustain switch. The sustain switch will have no affect on the Symphonizer Low Octave Keyer.

SCHEMATIC 10

PEDAL KEYING AND PEDAL WOW DRIVE

Pressing a bass pedal causes the following:

1) A pulse is developed across the .22 capacitor (connected to the CI Pedal Switch) causing the Pedal Cancel Trigger to operate.
2) A generator output Diode D244 is biased on, allowing tone generator signal to pass through D245 or D246 to the base of Pedal Collector Amp Q164 or Q165.
3) A 5.6 mfd capacitor is charged, which holds the Generator Output Diode on after the pedal has been released.
4) The Pedal Keydown Detector conducts, supplying the enable voltage for the Pedal Shimmer Generator, Pedal Trigger, Orchestral Symphonic Trigger and Mute and Detuning Trigger.

Q161, Q162 PEDAL CANCEL TRIGGER

Pressing a pedal develops a pulse across the .22 capacitor connected to the CI Pedal Switch. This momentarily lowers the voltage on the base of Q161, turning it off. When Q161 turns off, it applies a positive voltage pulse to the base of Q162. This causes Q162 to turn on, momentarily grounding the Pedal Keying Line which discharges any previously charged 5.6 uf pedal sustain capacitor. This turns off the signal path of the previously played pedal making sure that only the signal from the pedal being played enters the Pedal Divider. (If more than one signal at a time enters the Pedal Divider, rumble will occur.) The positive output from the collector of Q161 is also used to trigger the Pedal Wow and Pedal Rhythm circuits.

Q164 & Q165 HIGH AND LOW OCTAVE PEDAL COLLECTOR AMPS

High octave pedal signal (C2-C3 Pedal Switches) and Low octave pedal signal (Cl-Bl Pedal Switches) is applied to the base of their associated Pedal Collector Amp. Here the signal is amplified, providing the drive signal for the pedal divider. The divider outputs provide the audio signal for the 8- and 16-foot pedal voices. The 8-foot outputs are also routed to the Orchestral Symphonic Pedal keying circuit for use when the Orchestral to Pedal preset is on.

Q163 PEDAL KEYDOWN DETECTOR

Playing a bass pedal applies a positive voltage to the emitter of Q163. Because of its lower base potential Q163 turns on. This applies a positive voltage to the Pedal Shimmer Generator, Pedal Trigger, Pedal Orchestral Symphonic Trigger and Mute and Detuning Trigger enabling these circuits to operate.

PEDAL 8, PEDAL 16 KEYING

Pressing a pedal applies a positive voltage from the collector of Q163 to the base of Q168. This turns on Q168, lowering the voltage on the base of Q169 which also turns on. When Q169 turns on, a positive voltage is applied to the base of Q170. This keyer turns on applying positive voltage to the diode readout circuits at its emitter. This allows audio signal from the Pedal Divider to pass to the Pedal String and Pedal 8/16 filter circuits. The capacitor at the base of Q170 is charged by Q169. If sustain is off, the capacitor discharges through a resistor and the Pedal Sustain tabs to ground. If sustain is on, ground is removed and the capacitor discharges onto the base of Q170 holding them on. This allows audio signal to pass to the filtering circuits for a short time after the pedal has been released creating the pedal sustain effect. The positive output from the emitter of Q170 is also applied to the base of the Genie Bass Killer Q176.

Q176 GENIE BASS KILLER

The Genie Bass Killer Q176 has a positive voltage applied to its base from the Pedal Keyer Q170 each time a pedal is played. This voltage causes Q176 to turn on which grounds the output of the Genie Bass Emitter Follower Q187, cancelling the Lower Keyboard Genie Bass until the pedal is released. This makes it possible to play the bass pedals at various intervals while the Genie Bass is being used.

CIRCUIT DESCRIPTION

ORCHESTRAL TO PEDAL

With the Orchestral to Pedal tab on, a positive voltage turns on Q173 & Q175. With Q175 on, Q174 is enabled and when a pedal is pressed, a positive voltage is applied from the collector of Q163 through Q174. This voltage is routed to the Trumpet Mute Drive circuit and is also applied as a detuning pulse to the Master Oscillator, when the Orchestral Symphonizer voices using these effects are on. (See Schematic 18.)

With Q173 on, the Orchestral Symphonizer trigger is enabled by grounding the emitter of Q172. When a pedal is pressed, a positive voltage is routed to the base of Q172 from Q163. If at this time an Orchestral Symphonizer preset is on, collector voltage is supplied to Q172 from the Orchestral Symphonizer Driver and Q172 turns on. This lowers the voltage on the base of Q171, turning it on supplying positive voltage to the Orchestral Symphonizer pedal keyer circuit. The Orchestral Symphonizer pedal keyer circuit operates allowing audio signal to pass to the Orchestral Symphonizer filter circuits.

PEDAL WOW DRIVE

Normally the output Pin 4 of IC19C is high. When a positive pulse from the Pedal Cancel Trigger occurs, the output of IC19C goes low, which switches the output of IC19D high.

The feedback between IC19C and IC19D makes them a Set/Reset Flip/Flop. At the same time, the pulse from Q161 causes the Keydown Reset Q166 to discharge the .15 uf timing capacitor at the collector of Q167. The timing capacitor then charges through the Ramp Driver Q167 (giving a linear ramp). As the voltage on the capacitor increases, the output Pin 14 of IC20C follows it. When the output of IC20C is .6V higher than the voltage setting of the Range Control VR23 the output Pin 8 of IC20D (normally low) goes high, resetting the Set/Reset Flip/Flop causing the output of IC19D to go low. When IC19D goes low, the timing capacitor discharges through D252 and a 2.2M resistor. As the capacitor discharges, the output of IC20C follows it completing the drive waveform for the wow circuit for Symphonic Wow. The output of IC20C is applied to the Pedal Wow filter allowing signal to pass through the filter at the amplitude of the drive waveform.

SCHEMATIC 11

GENIE BASS, PEDAL & PEDAL WOW FILTERING & SWITCHING

GENIE BASS

Q180-Q182 HIGH & LOW BASS SELECTORS

With a Rhythm on, the output from Pin 26 of the ROM IC103 is applied to the bases of Q180 and Q181 through the Rhythm Start tab contacts. When Pin 26 is high, the High Bass note from Pin 6 of the CFG IC85 is grounded out through Q180 and the Low Bass note from Pin 7 of the CFG is allowed to pass to the base of Divider Driver Q183. When Pin 26 goes low, Q182 is turned on through Q181, grounding out the Low note allowing the High note to reach Q183. With no Rhythm on, the bases of Q180 and Q181 are held high allowing only Low Bass signal to pass to Q183. In the Boogie Woogie Bass mode, a positive voltage is routed from the Magic Chord tab to the bases of Q180 and Q181, allowing the signal output from Pin 7 of the CFG to reach the base of Q183.

NOTE: In the Boogie Woogie mode of operation, there is no audio signal output from Pin 6 of the CFG. The positive voltage from the Magic Chord tab holds Q182 off, assuring a constant signal path for the Low-Root output Pin 7 of the CFG.

Q183, PART OF IC102, DIVIDER DRIVER & GENIE BASS DIVIDER

Audio signal from Pins 6 & 7 of the CFG IC85 is applied to Q183 where it is amplified. This signal is applied to the Genie Bass Divider IC102 where it is frequency divided exactly in half. The signal output from the Divider is then applied to the Genie Bass Keyer Q186.

Q184, Q185 GENIE BASS PULSE DETECTOR & GEME BASS DRIVER

Turning on a rhythm triggers the Bass Pulse Detector from the Boogie Woogie Bass Triggers or Pin 22 of IC103 (depending on the position of the Boogie Woogie Bass tab). When the trigger is low, voltage on the base of Q184 is lowered, causing it to conduct. A positive voltage is then applied to the base of Q185, causing it to conduct which applies positive voltage to the Genie Bass Keyer Q186, gating the base signal through the keyer at the speed of the rhythm. When the trigger goes high, Q184 turns off, causing Q185 to turn off, shutting off the signal path through the Genie Bass Keyer.

With the rhythm off, the cathode of Diode D278 is grounded. This lowers the voltage on the base of Q184, turning it on, which applies a steady positive voltage to Q185, holding it on, creating a constant signal path through the genie Bass Keyer Q186, allowing the Low Bass signal to pass unmodulated.

NOTE: With the rhythm off, the cathode of D279 is also grounded. This creates a voltage divider network through the 560 ohm and adjusts the DC level on the base of Q185.

CIRCUIT DESCRIPTION

Q186 GENIE BASS KEYER
Audio signal from the Genie Bass Divider is applied to the Genie Bass Keyer Q186. Each time a positive pulse from the Genie Bass Driver Q185 is applied to Q186, it allows audio signal to pass through Q186. This signal is then applied to the Genie Bass Emitter Follower Q187.

Q187 GENIE BASS EMITTER FOLLOWER
Audio signal from the Genie Bass Keyer passes through Q187 and is transformed into a low impedance signal. This signal is then routed to the Genie String Bass and Guitar Bass Switchers Q188 and Q189.

GENIE GUITAR & STRING BASS SWITCHING
Turning on the Genie Guitar Bass tab applies positive voltage to Switchers Q188 & Q189. This turns on the FET Switchers allowing audio signal from Q187 to pass to the Guitar Bass and String Bass niters. Turning on the Genie String Bass tab or the Magic Chord tab with the Boogie Woogie Bass tab, applies a positive voltage to Q189 turning on FET Switcher Q189. This allows audio signal to pass to the String Bass Filter IC61B. The audio signal is filtered through IC73A & IC61B then passes to the Bass Mixing Preamp.

PEDAL 8, PEDAL 16
Audio signal from the 16-foot Pedal Keying is applied to the input of the Diaphone and Pedal 16 FET Switchers Q192 & Q194. Turning on the tabswitches applies a positive voltage to the cathode of D283 or D284, turning on the FET switchers. This allows audio signal to pass through the FET switchers to the Diaphone and Pedal 16 filtering circuits. After filtering the signal is routed to the input of the Bass Mixing Preamp IC73B.

Audio signal from the 8-foot Pedal Keying is applied to the input of the Pedal Keying is applied to the input of the Pedal 8 FET Switchers Q190 & Q191. Turning on the Pedal 8 tab turns on the FET switchers. This allows audio signal to pass through the FET switchers to the Pedal 8 filtering circuits. After filtering, the signal is routed to the input of the Bass Mixing Preamp IC73B.

PEDAL WOW
This circuit is a State Variable Filter that acts in conjunction with the .001 capacitors to form an RC low pass filter. Signal from the 8-foot Pedal Keying is gated through the filter at the amplitude of the drive waveform applied to Pins 5 of IC74 and IC75. The output is a low impedance signal that is routed to the Bass Mixing Preamp IC73B when the Pedal Wow tab is turned on.

IC73B, Q200 BASS MIXING PREAMP & EMITTER FOLLOWER
All Bass audio signal is routed to the Bass Mixing Preamp. Here the signal is amplified and routed to the base of Emitter Follower Q200. Depending on which of the Pedal Volume Switches is on, the resistance to ground at the output of IC73B is varied regulating the amplitude of the signal applied to the base of Q200. The audio signal applied to Q200 is transformed into a low impedance output signal and routed to the reverb circuit and the Main and Leslie amplifiers.

SCHEMATIC 12

FLUTE AND STRING CHORUS MODULATOR

All three channels, Phase 1, 2 and 3, of the Chorus Modulator are identical in operation. For discussion purposes the schematic references for Phase 1 are used in the description below.

Q213, Q214 CLOCK 1 AND PULSE SHAPER
Clock 1 Q214 oscillates at a frequency of 19Hz. The output from Clock 1 is applied to the Pulse Shaper Q213 where it is amplified and applied to the input of the high frequency Divide-by-3 network. Here the waveform is divided and appears as three outputs with a 120 degree phase shift between Pins 6 and 4, 4 and 2 and 2 and 6. With the Chorus Celeste switch in the Celeste position, Clock 1 is disabled, and the chorus runs at the speed of the low frequency clock, Clock 2.

Q205, Q206 CLOCK 2 AND PULSE SHAPER
Clock 2 Q205 oscillates at a frequency of 2.2Hz. The output from Clock 2 is applied to the Pulse Shaper Q206 where it is amplified and applied to the input of the low frequency Divide-by-3 network. Here the waveform is divided and appears as three outputs with a 120 degree phase shift between Pins 6 and 4, 4 and 2, and 2 and 6.

PHASE 1, 2 AND 3 FILTERS
The similar outputs from the high and low frequency divide-by-3 networks are combined and applied to a low pass filter tuned to approximately 1 Hz. The output from the filter is a low frequency, irregular sine wave which is used as the drive signal for the voltage-controlled oscillator.

CIRCUIT DESCRIPTION

IC78, IC80, IC82 VOLTAGE-CONTROLLED OSCILLATOR

The output of the voltage controlled oscillator is a triangle waveform 2 volts peak-to-peak with an average DC level of 5 volts. The frequency of this waveform is dependent on the amplitude of the drive signal from the filters. Since the drive signal is an irregular waveform, the output frequency of the oscillator is constantly varying. The output from the oscillator is then applied to the phase splitters.

Q217-219, Q225-227, Q233-235 PHASE 1, 2 AND 3 PHASE SPLITTERS

The collector and emitter outputs of Q217 follow the output from the voltage controlled oscillator (the collector output being inverted). When the collector of Q217 is high, Q218 turns on applying a negative pulse to Pin 5 of IC79. When the emitter of Q217 goes high, Q219 turns on applying a negative pulse to Pin 2 of IC79.

IC46B, IC46C, Q203, Q204 CHORUS INVERTER, MIXING PREAMP

Audio signal from the Vox Celeste and Lower String circuits is combined and amplified by the Chorus Inverter IC46B. This audio is then combined with audio signal from the Flute, String and Symphonic Wow circuits by Chorus Mixing Preamp IC46C and applied to the input preamps. The input preamps amplify this signal which is then routed to the inputs of the Phase 1, 2 and 3 Bucket Brigades.

IC79, IC81, IC83 BUCKET BRIGADE

The Bucket Brigades are analog shift registers which sample the input audio signal at the rate of the Clock pulses from the Phase Splitters. Each time a negative clock pulse is applied to Pin 2 and then Pin 5 of IC79, the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output at Pin 6. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The delay time of Phase 1, 2 and 3 are constantly varying but will never be the same at any one time. The audio signal output from the Bucket Brigade is then applied to the low pass filters.

Q220 & Q221, Q228 & Q229, Q236 & Q237 LOW PASS FILTERS

The low pass filters filter out the high frequency clock component that is contained in the audio signal. The outputs of the Phase 1, 2 and 3 Low Pass Filters are then cross-coupled for amplitude variation before being applied to the output amps.

Q222, Q230, Q238 PHASE 1, 2 AND 3 OUTPUT AMPS

The audio signal from the low pass filters is applied to the output amps where it is amplified and routed to the Main, Phase 2 and Phase 3 Volume Regulators.

SCHEMATIC 13

AUTOMATIC ORGAN COMPUTER (AOC)

Automatic Organ Computer (AOC) consists of Upper Keyboard AOC keyswitches (C3-C6), Lower Keyboard DC keyswitches (C1-C4), and in the Magic Chord mode the Magic Genie AOC Decoder is used in place of the A1-A2 DC keyswitches. Listed below is an example of what happens when a C Major chord is held on the Lower Keyboard and the C6 Upper Keyboard key is pressed.

1) **With the AOC tabswitch on, holding a three-finger or a one-finger Magic C Major chord (C, E and G) on the Lower Keyboard applies a positive voltage (from the C1-C4 Lower Keyboard keyswitches or the Magic Genie AOC Decoder) to the C, E and G AOC Drivers. Here the voltage is amplified and applied to the emitters of all the C, E and G AOC Keyers Q241 via Diodes D297.**
2) **Upon pressing the Upper Keyboard C6 Key:**
   a) **the C6 DC keyswitch contact (see Schematic 2) receives a positive voltage from its on buss and keys the C6 note through the Upper Keyboard Diode Keying circuitry.**
   b) **the C6 AOC keyswitch contact is grounded by its on buss which lowers the voltage on the base of nine AOC keyers - namely C#5, D5, D#5, E5, F5, F#5, G5, G#5 and A5. Since in this range only E5 and G5 have voltage applied to their emitters from the Lower Manual keyswitches or the Magic Genie AOC Decoder (via the AOC Drivers) they are the only two AOC keyers that will conduct, applying voltage to the Upper Keyboard E5 and G5 Diode Keying circuit. Thus, E5 and G5 will be heard along with C6. The output from the AOC Drivers is also applied to the Golden Harp Enable Transistors Q473.**

Q244 GOLDEN HARP ENABLE

Each time a Lower Keyboard key is pressed, the voltage at the base of Q244 will decrease turning on Q244. This applies a positive voltage to the base of Golden Harp Enable Switcher Q244 turning it on. A low is routed to the Harp Enable Line (Schematic 22).

CIRCUIT DESCRIPTION

SCHEMATIC 14

CHORD FUNCTION GENERATOR [CFG]

CHORD FUNCTION GENERATOR IC85

The Chord Function Generator IC85 contains a scanning system, five programmable frequency generators and the required logic to provide four output features which are bass, chord, strum and arpeggio. The scanning system is capable of scanning 72 time points on a sequential basis. The scan matrix is partitioned in a 12 (X scan) by 6 (Y scan) array. Sequential pulses are outputted on the 12 X lines and a particular time point is active when one of the X lines is connected to one of the Y lines. In the non-chord mode (Magic Genie Chord tab off) the bass feature is the only function that is enabled. In this mode of operation bass signal is outputted from Pins 6 & 7 of the CFG. In the chord mode (Magic Genie Chord tab on) circuitry is enabled to add data bits. These bits correspond to the notes in the chord being played. For example, if a chord is being played there will be data bits at 3 of the 72 time points. If the A2 Key (which is the 7th switch) is pressed, a fourth data bit is added to the chord; pressing the minor footswitch shifts the data at one of the time points creating the minor of the chord being played. The minor and 7th of the chord reset with each new keydown. The other features of the chip, strum and arpeggio, can also be enabled when the chip is in the chord mode. All the features are outputted when a key is pressed. If the chord hold tab is turned on, the features latch and will continue to play after the key is released. Turning on a rhythm disconnects Pin 21 of the CFG from Pin 31 of the CFG. This sets up the CFG to accept rhythm pulses for triggering the Boogie Woogie Bass sequence.

NOTE: The Arpeggio, 7th, Minor, Chord Hold, Magic Chord and Any Rhythm On features of the CFG are inverse functions. This means that the time points for these functions are active when the feature is not playing. To enable these functions to operate, the X and Y lines associated with them must be disconnected.

Q287 CHORD FUNCTION MASTER OSCILLATOR

Q287 develops a continual high frequency signal of approximately 500 KHz that is applied to Pin 3 of IC93B and IC96B. With the D input and Q bar output of IC93B tied together, IC93B becomes a divide-by-two divider. It also acts as a buffer stage between the Master Oscillator and the CFG. The divided-by-two clock frequency from IC93B is applied to five programmable frequency generators via Pin 24 of the CFG IC85. The programmable generators are each capable of generating one of 12 frequencies, dependent on the address code provided them. These generators supply the audio signal for the bass in both the chord and non-chord mode of the CFG. The generators also supply the audio signal for the Magic Chords, Strum and Arpeggio features in the chord mode of the CFG. The divided clock frequency from IC93B is also applied to IC95A&B where it is divided-by-two twice and routed to the Clock Input of the Magic Genie AOC and 4-foot Decoder IC99. The signal output from Q287 that is applied to IC96B is divided-by-three by IC96A&B with an output of approximately 166 KHz at Pin 9 of IC96B. This signal is applied to Pin 2 of IC97 and IC98 where it is divided and used for the 4-foot Magic Chord signal.

MAGIC GENIE CHORDS

Turning on the Magic Chord tabswitch performs the following functions:

1) The base of 7th Enable Q271 is ungrounded allowing positive voltage to reach its base.
2) Positive voltage is routed through Diode D338 to the base of B.W.Bass Enable Q274 when B.W. Bass tab is on.
3) Positive voltage is applied to the base of Q280 Magic Chord tab "on" switcher. This turns on Q280 and disables the Lower Keyboard A1-A2 keyswitch by grounding the keying voltage through Diodes D174-D186.

   When Q280 turns on, it also causes Q281 Serial Data Switcher to turn off, allowing the Serial Data from Pin 23 of the CFG to pass to Magic Genie AOC and 4-foot Decoder IC99.
4) Positive voltage is applied to Pin 8 of IC87D Magic Chord Enable locking its output Pin 10, high. This blocks the negative transition of the X line at Pin 29 from the Y line of Pin 21 and puts the CFG in the chord mode of operation.

Pressing a Magic Chord keyswitch (Al-G#2) at this time causes data bits to appear at three CFG time points. These data bits provide the address code for the programmable frequency generators, causing three audio frequencies that form a specific chord to be outputted at Pin 5 of the CFG. These audio signals are then applied to the Magic Chord Preamp Q277 where they are amplified and routed to the Lower Keyboard 8-foot Filter circuits. Magic Chord Squelcher Q279 has positive voltage applied to its base from the Magic Genie AOC Decoder each time a Lower Keyboard key is pressed, turning on Q279 which turns off Q278 and ungrounds the Magic Chord output. With no lower keys held, Q278

grounds the Magic Chord output preventing any leakage that might occur.
NOTE: In the Magic Chord Mode of Operation, only the highest chord being played will sound.

MAGIC GENIE AOC

With the Magic Chord tab on, holding down a chord keyswitch outputs information on the Serial Data stream (Pin 23 of the CFG) which corresponds to the chord being played. Under these conditions, Serial Data Switcher Q281 is turned off through Magic Chord "On" Switcher Q280, and the Serial Data information passes through Inverter Q282 to the input Pin 3 of the Magic Genie Flute AOC and 4-foot Decoder IC99. The output Pin 6 of IC93B (approximately 250 KHz) is applied to IC95A&B where it is frequency divided by four and routed to the Clock Input Pin 2 of IC99. The Serial Data Information is transferred into IC99 with each clock pulse at Pin 2. At time point 72 (at the end of the CFG Scan) a sync pulse occurs at Pin 22 of the CFG. The sync pulse clocks Pin 3 of IC94A causing the Q output to go high, holding the D input of IC94B high. When the next clock pulse occurs at Pin 11 of IC94B, the Q output at Pin 8 will go low resetting dividers IC95A&B and transferring the AOC information out of IC99. If for instance a C Magic Chord was being held this would result in a positive voltage on the C, E & G lines or Pins 14, 18 & 21 of IC99. This positive voltage is then routed to the AOC drivers. From this point, the AOC operates as described under the Schematic 13 heading.

MAGIC GENIE 4-FOOT TOS

Audio signal from the Chord Function Master Oscillator is divided-by-three by IC96A&B producing a signal of approximately 166 KHz at Pin 9 of IC96B. This signal is applied to Pin 2 of IC97 and IC98 where it is divided simultaneously producing twelve specific audio frequencies. These frequencies are used for the Lower Keyboard 4-foot voices when the CFG is in the chord mode of operation. Serial data information corresponding to the Magic Chord being held is clocked into Magic Genie AOC and 4-foot Decoder IC99.

At the end of the CFG scan (time point 72), a sync pulse from IC85 is transferred through IC94A&B and applied to Pin 37 of IC99. The negative edge of this pulse transfers the chord information out of IC99 which results in a positive voltage at the anodes of three diodes D371. The diodes are forward biased allowing three audio signals that form a specific chord to pass to the lower keyboard 4-foot filtering circuits.

CHORD HOLD ENABLE

With the Chord Hold tab off, Pin 12 of IC87C is held low. This causes the output of IC87C at Pin 11 to follow the X line from Pin 28 of the CFG. This in effect connects the X Scan Line at Pin 28 to the Y Scan Line at Pin 21 and is the condition of the CFG chip when the Chord Hold feature is not operating. Turning on the Chord Hold tabswitch locks the output of IC87C high, disconnecting the X and Y Scan Line which puts the CFG in the Chord Hold Mode. In this mode of operation, all Magic Genie functions will continue to be outputted after all Lower Keyboard keys are released.

7TH ENABLE

With the Magic Chord tab on, positive voltage from Q272 is applied to the base of Q271 turning it on. This connects the X output on Pin 26 of the CFG to the Y line at Pin 21 and activates the 7th time point of the CFG. This is the condition of the CFG when the 7th of the chord is not being played. To enable the 7th to play, Pin 26 and Pin 21 must be momentarily disconnected. This is accomplished by the following: Pressing the A2 keyswitch applies a positive voltage to the base of Q272, turning it on which removes positive voltage from the base of Q271 and turns it off. When Q271 turns off, the X and Y lines are disconnected, deactivating the 7th time point which adds the 7th component to the Magic Chord being played.

MINOR ENABLE

When the minor of the chord is not being played, Minor Enable Q273 is held on which holds Pin 2 of IC87B low. With Pin 2 of IC87B held low, its output at Pin 3 will follow the X line from Pin 27 of the CFG. This in effect connects the X line at Pin 27 to the Y line at Pin 21 and is the condition of the CFG when the minor is not being played. To enable the minor to play, Pin 27 and Pin 21 must be momentarily disconnected. This is accomplished by the following: activating the minor switch (located to the right on the expression shoe) lowers the voltage on the base of Q273 turning it off. This causes Pin 2 of IC87B to go high, which in turn locks its output Pin 3 high. With Pin 3 held high, the negative transition of the X line at Pin 27 of the CFG is not passed to the Y line at Pin 21. This deactivates the CFG time point for the minor, changing the Magic Genie chord being played to a Minor chord.

CIRCUIT DESCRIPTION

STRUM

STRUM ENABLE

Holding a chord keyswitch with the Magic Chord tabswitch on, outputs the frequencies of the chord being played on the four strum signal lines Pin 1,2,3 and 40. If the Ukulele tab is on, the X line at Pin 32 of the CFG is connected through the Ukulele Strum Enable Gate IC86D to the Y line at Pin 21 and the frequencies outputted on the signal lines will be one octave higher. Each time a pulse occurs at Pin 15 of the CFG from the Strum Trigger Q291, a sequence of keyer pulses are generated and outputted on the four Strum Keying Lines, Pins 8, 9 10 and 11. The frequency of this sequence of keyer pulses is determined by the RC network on Pin 14 of the CFG. The first keyer pulse appears on the Root Keying Line, then the 3rd, 5th and 7th. If the 7th of the chord is not enabled (see 7th Enable), the sequence will not include a pulse on Pin 8 for the Strum 7th signal. The pulses on the four keying lines are applied to the anodes of Diodes D357, D360, D363 & D366 turning them on, allowing audio signal on the four strum signal lines to pass to the Strum Preamp Q276. Here the signal is amplified and routed via either the Guitar or Ukulele Strum tabs to various voicing circuits.

STRUM TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Q284, turning it on. This lowers the voltage on the base of Q285 which turns off. When Q285 turns off, it applies a positive voltage to Pin 1 of Strum Trigger Gate IC92B. With Pin 1 of IC92B held high, it acts as an inverter and its output at Pin 3 will be the inverted input applied to Pin 2. The input at Pin 2 can come from the ROM IC103 Pin 22 or Pin 23 or from the Boogie Bass Trigger gates, depending on the position of the Strum/Upbeat/Downbeat tab and the Boogie Bass tab. The output of IC92C can be considered high, so when Pin 3 of IC92B goes high a negative pulse results at Pin 8 of IC92D, momentarily lowering the voltage on the base of Q291 turning it off. When Q291 turns off, its collector applies a positive pulse to Pin 15 of the CFG IC85 triggering the strum sequence. For the above-mentioned rhythms, the strum sequence will occur with the Accompaniment pulse when the Strum tab in the Upbeat position, and with the bass pulse in the Downbeat position (Boogie or High/Low Bass, depending on the position of the Boogie Bass tab). Using any rhythm except the above-mentioned causes the following: Q284 is off, which applies a positive voltage to the base of Q285. This turns Q285 on, holding Pin 1 of IC92B in a low state. With Pin 1 of IC92B held low, its input at Pin 2 has no effect and its output at Pin 3 is locked high. The high output from Pin 3 is applied to Pin 4 and 10 of IC92 causing these gates to act as inverters. The Trigger Pulse at the output of IC92D will follow the negative transition of the counter output fromIC102 Pin 12. Putting the Strum tab in the downbeat position inverts the output from Pin 12 through IC92A. The trigger output at Pin 8 of IC92A will now follow the positive transition of the counter output from Pin 12. For the specific time point where the strum sequence occurs for each rhythm, see the Rhythm Patterns Diagram in the Chart Section of this manual.

ARPEGGIO

ARPEGGIO ENABLE

The X line at Pin 25 of the CFG is not connected to the Y line at Pin 21 of the CFG. This enables the internal CFG Arpeggio Shift Register. Pulses are applied to the shift register from one side of the internal Arpeggio Clock Oscillator. The shift register advances with every other transition of the clock and generates a keying pulse which appears on Pin 13 of the CFG. The clock is triggered from the Arpeggio triggers through Pin 12 of the CFG. The shift register also addresses a multiplexer which has as its input 3 octaves of root, 3rd and 5th frequencies of the Magic Chord being played. The output of the multiplexer passes through some gating and appears on the arpeggio signal line, Pin 39 of the CFG. A different frequency is outputted on Pin 39 each time the shift register advances. When the keyer pulse is present on Pin 13, D354 is turned on allowing the audio signal on Pin 39 to pass to the Arpeggio Preamp Q275. Here the signal is amplified and routed through the Piano or Harpsichord Arpeggio tab to the Piano Filter or Harpsichord Filter.

ARPEGGIO TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Gate Selector Q284, turning on Q284 which in turn switches Q285 off. With Q284 on, Pin 12 of IC91B is held low, disabling this gate. With Q285 off, Pin 8 of IC91A is held high, causing this gate to act as an inverter. The input at Pin 9 of IC91A is the delayed strobe pulse. When the positive strobe pulse occurs, Pin 10 of IC91A goes low applying an arpeggio trigger pulse to Pin 12 of the CFG. If a rhythm is being used that is not mentioned above, IC91A will be disabled and IC91B

will act as an inverter due to the condition of Q284 & Q285 and the off condition of the above-mentioned rhythms. The input on Pin 13 of IC91B is the delayed strobe pulse which has been frequency divided-by-two through Gate IC88A. When the strobe pulse occurs, Pin 11 of IC91B goes low applying an arpeggio trigger pulse to Pin 12 of the CFG. Because of the nature of the Arpeggio Clock (see Arpeggio Enable), the frequency of the keyer pulse at Pin 13 of the CFG will be half that of the frequency of the trigger pulse applied to Pin 12.

HIGH/LOW BASS

With the Magic Genie Chord tabswitch off, the only feature of the CFG chip that is outputted is the High/Low Bass. In this mode of operation, holding down two or more lower keyboard keyswitches (A1-C4) causes the following: Audio signal corresponding to the lowest note being played is outputted from Pin 7 of the CFG and the highest note is outputted from Pin 6. These signals are routed through High/Low bass select circuits to the base of Q183 Divider Driver (see Schematic 11). With no rhythm on, positive voltage from the Rhythm Start tabs is applied to the select circuits allowing only low bass signal to pass to Q183.

ROOT/FIFTH BASS

With the Magic Genie Chord tabswitch on, the bass feature of the chip is in the Root/Fifth mode of operation. If a Magic Genie Chord (one-note chord) is held at this time, the audio signals at the bass root output (Pin 7) and bass 5th output (Pin 6) are the root and 5th components of the chord being played. These signals are routed through High/Low bass select circuits to the base of Q183 Divider Driver (see Schematic 11). With no rhythm on, positive voltage from the rhythm start tabs is applied to the select circuits allowing only the root bass signal to pass to Q183.

BOOGIE WOOGIE BASS

BOOGIE WOOGffi BASS ENABLE

Turning on the Boogie Woogie Bass tab with the Magic Chord tab on, allows positive voltage to pass through Diode D339 to the Low Bass Selectors Q181 and Q182 and also through Diode D338 to the base of Q274. The voltage applied to the bass selectors holds the signal path for the Low Bass signal on. (In the Boogie Woogie Bass mode, audio signal is only outputted from Pin 7 of the CFG.) The voltage applied to the base of Q274 turns Q274 on. This holds Pin 6 of IC86B low and also resets the Boogie Woogie Bass shift register through Pin 6 of the CFG. With Pin 6 of IC86B held low, its output at Pin 4 follows the X Scan Line from Pin 30 of the CFG. This puts the CFG bass feature in the Boogie Woogie mode.

Under the above conditions with a rhythm on (see Any Rhythm On Gate IC86C), 5 signals are multiplexed to the bass Low/Root output, Pin 7 of the CFG. The multiplexer is controlled by a shift register. Each time a trigger pulse is applied to Pin 37 of the CFG from the Boogie Bass Triggers, the shift register advances one position and outputs the next signal in the bass sequence. The signal is outputted at Pin 7 of the CFG, then routed through the Low Bass Selectors to the base of Divider Driver Q183. If a keydown occurs before the bass sequence is complete, the shift register will reset to the starting point.

BOOGIE WOOGIE BASS TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Gate Selector Q284. This causes Q284 to turn on which in turn causes Q285 to turn off. With Q284 on, Pin 5 of IC91D is held low, disabling this gate. With Q285 off, Pin 1 of IC91C is held high causing this gate to act as an inverter. The input at Pin 2 of IC91C originates at Pin 11 of IC89A. The output from the clock multivibrator is applied to Pin 11 of IC89A where it is frequency divided-by-two; output is applied as input to IC89B. IC89B, IC90A and 90B comprise a divide-by-three divider with the output at Pin 5 of IC90B. The input at Pin 1 of IC88B is the strobe pulse. This causes the output at Pin 3 of IC88B to have a pulse width equal to the strobe pulse and a frequency which is the Counter input frequency (Pin 7 IC102) divided-by-three. When Pin 3 of IC88B goes high, a negative pulse results at the output Pin 3 of IC91C (since IC91C acts as an inverter) lowering the voltage on the base of Q290 and turning it off. This applies a positive Boogie Woogie advance pulse to Pin 37 of the CFG. Q289 holds Q290 off momentarily which increases the pulse width of the trigger pulse. At the end of the rhythm measure a negative reset pulse is applied to the Boogie Bass Pulse Dividers, setting the output Pin 5 of IC90B high.

If any but the above rhythms are on, Gate IC91C will be disabled and IC91D will act as an inverter due to the state of Q284 & Q285 and the off condition of the above-mentioned rhythms. The input at Pin 6 of IC91D originates at Pins 12 & 13 of IC88D. The input at Pin 12 of IC88D is the counter input frequency (Pin 10 of IC102) divided-by-two and the input at Pin 13 is the counter input frequency divided-by-four. This causes the output at Pin 11 to be the frequency of the

CIRCUIT DESCRIPTION

Pin 13 input, having a pulse width equal to the Pin 12 input. This output is then applied to Pin 9 of Gate IC88C, the input at Pin 8 of IC88C is the strobe pulse, the output at Pin 10 will be the strobe pulse at the divided-by-four counter input frequency. When Pin 10 of IC88C goes high, a negative pulse results at the output Pin 4 of IC91D (since IC91D acts as an inverter). This pulse is applied to the base of Q290 which operates as described above. The output from Pin 9 of IC89A also drives the Golden Harp when a rhythm and rhythm sync switch are on.

Q283 RHYTHM & INTRO ON SWITCHER

With no rhythms on, positive voltage from the anode of D379 (see Drawing 15) is applied to the base of Q283 holding it on. Switching on a rhythm lowers the voltage on the base of Q283 through Rhythm Start Switcher Q128 (see Schematic 7). This causes Q283 to turn off applying a positive voltage to the Any Rhythm On Gate IC86C, the Rhythm On Vibrato Killer Q286 and the Strum Trigger Disable Q288. Q283 also performs two functions related to the Golden Harp: 1) Each time the rhythm switches off, a negative reset pulse is applied to Pin 13 of IC89A through D345. This sets the Q output low, and 2) Q283 grounds the "on" of a rhythm sync switch contact. This makes it possible for the Golden Harp to operate from the Harp speed oscillator if the sync switch happens to be on without a rhythm on. With the rhythm off, the base of Genie Accompaniment Switcher Q127 is held low turning off Q127 and applying a steady DC to the Accompaniment Modulator. (See Schematic 7.)

Pressing the Intro switch applies positive voltage to three CFG circuits: 1) through Diode D343 to the base of Q283. This turns Q283 on, disabling the Strum Trigger; 2) through Diode D344 to Pin 13 of IC89A. This prevents IC89A from becoming disabled when Q283 turns on for Intro, and 3) through Diode D348 to the bases of Q284 & Q285, turning them on, disabling the Arpeggio and Boogie Bass Trigger Gates.

IC86C ANY-RHYTHM-ON GATE

With no rhythm on, Pin 2 of IC86C is held low by the on condition of Q283. This allows the X Scan output from Pin 31 of the CFG to pass to the Y Scan Line at Pin 21. Under this condition the internal Boogie Woogie Bass multiplexer is locked in the root position and outputs the Low/Root note from Pin 7 of the CFG. With a rhythm on, the collector of Q283 goes high disabling IC86C blocking the X Scan output from the Y scan. This tells the multiplexer a rhythm has been switched on allowing it to advance with each Boogie Bass Trigger pulse applied to Pin 37.

Q286 RHYTHM ON VIBRATO KILLER

With a rhythm on, the collector of Q283 Rhythm and Intro On Switcher goes positive. This positive voltage is applied to the base of Q286 turning it on. When Q286 turns on, it grounds the output from the vibrato oscillator preventing it from reaching the Chord Function Master Oscillator Q287. This cancels the vibrato effect on the Magic Genie features when a rhythm is on.

Q288 STRUM TRIGGER DISABLE

Pressing the Intro tab turns on Q283 Rhythm and Intro On Switcher, which removes positive voltage from the base of Q288 turning it off. When Q288 turns off, it removes the voltage at the collector of the Strum Trigger Q291 disabling Q291, cancelling Strum for the duration of the Intro Set.

IC93A BOOGIE INTRO RESET

After the Intro Set there is a one clock pulse-delay before the rhythm restarts. The Boogie Intro Reset blocks this pulse from Triggering the Boogie Bass Trigger so the rhythm and bass sequence start together on the second clock pulse after Intro. This is accomplished by the following: Pushing the Intro tab turns on Q283. This puts a low on Pin 13 of IC93A which locks the output Pin 8 high. When the first clock pulse occurs after Intro, the output of the Boogie Trigger Gates will go low but the Boogie Bass Trigger Q290 does not feel this negative transition because Pin 8 of IC93A is still held in a high state. When the output of the Boogie Bass Trigger Gate is making a positive transition IC93A clocks and the Q output from Pin 8 locks in a low state. On the next clock pulse, the Boogie Bass Trigger Gate goes low and is now able to turn on Q290 and trigger the Bass Advance input of the CFG.

SCHEMATIC 15

AUTOMATIC RHYTHM

The Clock Multivibrator oscillates, producing a square wave output at the collector of Q297. This output is applied to the strobe delay transistor and through Divide-by-two D Flip-Flop IC89A to the Resetable Counter. The Resetable Counter divides the input from IC89A by two, between Pins 10 & 11, 11 & 12, 12 & 13 and 13 & 14. The combined outputs of Pins 10 - 14 are applied to Brush Decoder circuits, which determine the brush length of some rhythms and also to Pins 35 - 39 of the Read Only Memory (ROM). Within the ROM, the combined inputs from the counter are decoded which results in a positive voltage appearing on one of the 32 internal decoder lines. As the combined inputs from the counter change, this positive voltage shifts in succession

from the 1st through the 32nd decoder line, giving 32 possible rhythm timing points. (In the case of triplet or waltz rhythms, the counter is reset before counting through 32 points.) The Decoder Lines then connect through gating circuits to matrix circuits. Turning on a Rhythm Selector switch connects the strobe pulse to the ROM. The strobe pulse enables the gating circuit for the rhythm chosen. This allows the voltage on the decoder line, that is positive at this time, to pass through the matrix where it is inverted and routed out of the ROM to the correct instrumentation circuit for that timing point and rhythm. The instrumentation circuits produce the rhythm voice which is then amplified and applied to the rhythm output amp.

Q295 MULTI-STARTER

Pressing the start tabswitch (or pressing a lower keyboard key with the Rhythm Start tab in the auto position) lowers the voltage on the base of the multi-starter Q295. Lowering the voltage at this point performs two functions: 1) A pulse is created across the .05 capacitors applying a negative pulse to Pins 3, 5 and 6 of the Resetable Counter, thereby resetting the counter to timing point 1 (Pins 10-14 will be positive at this time) and 2) Multi-Starter Q295 turns on, supplying voltage to the Clock Multi-Vibrator Transistor Q297, enabling the clock to run.

Q297, Q298 CLOCK MULTI-VIBRATOR

A positive voltage from the Multi-Starter is applied to the Clock Multi-vibrator which enables it to run. The Clock runs continuously producing a square wave output at the collector of Q297. The positive edge of this output triggers the Boogie Bass Pulse Dividers IC89A and the resetable counter and the negative edge triggers the strobe delay transistor. The tempo at which the clock runs is controlled by the rhythm tempo control and various slow down circuits.

RHYTHM STROBE PULSE

The rhythm strobe pulse is developed at the collector of the Rhythm Strobe Keyer Q329. Selecting a rhythm connects this pulse to the ROM where it enables the 32 ROM decoder lines, allowing them to trigger the instrumentation circuits. The strobe pulse is slightly delayed in relation to the ROM decoder outputs. This allows the decoder functions to stabilize before the strobe pulse enables their output.

Q325, IC88A & Q292 STROBE DELAY, GATE & DRIVER

When the output of Clock Transistor Q297 is low, a negative pulse is created across the .01 capacitor at the base of Q325. This lowers the voltage on the base of Q325 turning it off, creating an output pulse at its collector that is one clock pulse delayed. This pulse is then routed to Pin 6 of Strobe Gate IC88A (shown on Drawing 14.) The other input to IC88A on Pin 5 is the divided-by-two clock frequency. The output of IC88A will be the pulse width of the strobe pulse at the frequency of the divide-by-two clock. When the output of IC88A is high, Q292 is turned on momentarily lowering the base voltage of the Strobe Keyer (Q324, Q327, Q329) that is in operation at the time.

Q329 RHYTHM STROBE KEYER

With the Intro off, the emitter and base of Q329 are positive. When Q292 conducts, it momentarily lowers the base voltage on Q329 causing it to turn on. This develops a positive output pulse at the collector of Q329. Turning on a rhythm selector switch connects this pulse to the ROM input for the rhythm selected. This pulse is routed to the gating circuit for that rhythm and allows the output from the ROM decoder to pass to the rhythm matrix, where the instrumentation circuits for that timing point are selected.

IC102 RESETABLE COUNTER

The Resetable Counter is a five-stage divide-by-two divider, the output of each stage connected to the input of the next. The 1st through 5th divider outputs are Pins 10 through 14, respectively. Applying a negative pulse to Pins 3, 5 and 6 resets the counter to timing point 1 (at this time all five outputs are positive). The five outputs are applied as input to the ROM and are also used to trigger the reset, brush decoder, strum and boogie bass circuits.

IC103 READ ONLY MEMORY [ROM]

The five inputs from the Resetable Counter are applied to the ROM. These inputs are decoded which results in a positive voltage appearing on one of the 32 internal decoder lines. There is a separate matrix for each rhythm pattern and each matrix has a gating circuit between it and the 32 decoder lines. Turning on a rhythm switch connects the strobe pulse to the gating circuit for the rhythm selected. The strobe pulse enables the gating circuit and allows the voltage on the positive decoder line to pass to the matrix. Here the voltage is inverted and routed to the instrumentation circuits for that timing point and rhythm. As the inputs to the ROM change, the positive voltage counts down the 32 decoder lines

one at a time and each time it is pulsed through the matrix by the strobe pulse. This creates the 32 timing points for the rhythm.

Q299 RESET INVERTER

The Reset Inverter has positive voltage pulses applied to its base from the Waltz Reset Line, the Intro End Rhythm Reset Line, the Intro Resetable Counter Reset Line and the Intro Hold Reset. Each time a positive pulse is applied to the base of Q299, it conducts creating a pulse across the .01 capacitors at the anodes of D380 and D381. This momentarily removes the positive voltage on Pins 3, 5 and 6 of the Counter IC102, which resets the counter to the first rhythm timing point. At this time Pins 10-14 are positive.

TRIPLET TIMING

The Ballad, Swing March, Dixie, Swing and Shuffle rhythms are triplet timing rhythms. This means that they only use 24 of the available 32 rhythm timing points. The purpose of the triplet circuitry is to reset the counter to the first timing point after 24 timing points and also to slow down the clock multi-vibrator.

Q313, Q314 TRIPLET, CLOCK SLOW DOWN SWITCHER & RESET ENABLE, TRIPLE RESET

Turning on the Ballad, Swing March, Dixie, Swing or Shuffle rhythm selector switch applies a ground to the Triplet Enable Line. This lowers the voltage on the base of Q313, turning it on. When Q313 turns on, it applies a positive voltage to two places: 1) Through Diode D395 and a 10K resistor to the clock slow down line and 2) Through Diode D396 to the collector of Q314. Q314 is normally held on by a positive voltage through Diodes D397, D398 or D399. When the 24th timing pulse is reached, the outputs of the counter which are connected to these diodes will all be low. This causes Q314 to turn off, allowing its collector to go positive. On the next clock pulse a positive voltage is applied to the base of Q314 turning it on. This creates a negative pulse on Pins 5 and 6 of the counter and resets all the counter outputs to positive or back to the first timing point.

Q311 SWING MARCH, CLOCK SLOW DOWN SWITCHER

Turning on the Swing March, triplet rhythm applies a ground to the Swing March slow down line. This lowers the voltage on Q311 causing it to turn on. When Q311 turns on, it applies a positive voltage to the clock slow down line. This voltage is higher than the voltage applied to the clock from Q313 and causes the clock to run slower for the Swing March rhythm.

WALTZ TIMING

The Waltz and Swing Waltz rhythms are three quarter time rhythms. This means that they only use 18 of the available 32 rhythm timing points. The purpose of the waltz circuitry is to reset the counter to the first timing point after 18 timing points and also to slow down the clock multi-vibrator.

Q316, Q317 WALTZ CLOCK SLOW DOWN SWITCHER & RESET ENABLE, WALTZ RESET

Turning on the Waltz or Swing Waltz rhythm selector switches applies a ground to the Waltz enable line. This lowers the voltage on the base of Q316, turning it on. When Q316 turns on, it applies a positive voltage to two places: 1) Through Diode D401 and a 10K resistor to the clock slow down line and 2) Through Diode D402 to the collector of Q317. Q317 is normally held on by a positive voltage through Diode D404 or D405. When the 18th timing pulse is reached, the outputs of the counter that are connected to these diodes will all be low. This turns Q317 off, allowing its collector to go positive. This positive voltage is applied as a pulse to the base of the Reset Inverter, Turning it on which applies a negative pulse to Pins 3, 5 and 6 of the counter. This resets all the counter outputs to positive or back to the first timing point.

BRUSH LENGTH CONTROL
[See Brush Keying]

The length of the brush voice for each rhythm (except for the Waltz, Swing March, Swing and Rock I rhythms, which do not use the brush voice) is regulated by varying the discharge rate of the .27 uf capacitor at the base of the Brush Keyer Q342. (See Schematic 16.) Turning on one of these rhythm selector switches connects a resistor to ground from the "on" of the selector switch to the Brush Length Control Line. The value of the resistance regulates the discharge rate of the .27 uf capacitor, thereby regulating the length of the brush voice. The length of the brush voice for some of these rhythms varies at different timing points. Turning on one of these rhythms enables a decoder circuit, which will allow a positive voltage to reach the base of the Brush Length Regulator Q305 at certain timing points. These pulses turn on the Brush Length Regulator adding a 150K resistor to ground to the brush length control line. This causes the .27 uf capacitor to discharge faster, giving a shorter brush voice for the timing point when Q305 is on.

NOTE: The 150K resistor added to ground by the Brush Length Regulator parallels the resistance to

ground from the "on" of the rhythm selected. This means there is less resistance to ground when Q305 is turned on, causing the .27 uf capacitor to discharge faster.

Q301, Q302 & Q304 ROCK II & ROCK III BRUSH DECODER ENABLERS & BRUSH DECODER

Turning on the Rock H or III Rhythm Selector Switches 1) connects a 470K resistor to ground through Diodes D434 or D435 and, 2) applies a positive voltage through Diodes D429 or D430 to the base of Q302. This positive voltage turns on Q302 removing positive voltage from the base of Q301 which now turns off and ungrounds the outputs of Diodes D387 and D388. Each time Pin 12 of the Counter IC102 goes high, a positive voltage will be applied through D387 to the base of Q305. Positive voltage will only be applied to the base of Q305 from D388 when Pin 13 of IC102 is high and Pin 11 is low. When Pin 11 is low, the Rock II and III Brush Decoder Q304 turns off and allows any positive voltage on Pin 13 to pass through D388 to the base of Q305. Positive voltage applied through D387 or D388 to the base of Q305 turns Q305 on which connects a 150K resistor in parallel with the 470K resistor to ground from the Brush Length Control Line. This causes the .27 uf capacitor at the base of the Brush Keyer Q342 to discharge faster giving a shorter brush length at the timing points when Q305 is on.

Q303 SAMBA, BOSA NOVA & LATIN ROCK BRUSH DECODER

Turning on the Samba, Bosa Nova or Latin Rock rhythm selector switches connects a 470K resistor to ground from the Brush Length Control Line and also allows positive voltage to pass through Diode D431, D432 or D433 to the collector of Q303. If Pin 12 of the Counter IC102 is low, Q303 is off and this positive voltage will pass through D385 to the base of Q305. If Pin 12 of IC102 is high, Q303 will turn on and ground the path through D385 to the base of Q305. Positive voltage applied through D385 to the base of Q305 turns Q305 on which connects a 150K resistor in parallel with the 470K resistor to ground from the Brush Length Control Line. This causes the .27 uf capacitor, at the base of the Brush Keyer Q342, to discharge faster giving a shorter brush length at the timing points when Q305 is on.

Q306 MARCH POLKA BRUSH DECODER

Turning on the March Polka Rhythm Selector Switch connects a 1M resistor to ground from the Brush Length Control Line and also allows positive voltage to pass through to the collector of Q306. If Pin 25 of the ROM IC103 is low, Q306 will be off and this positive voltage will pass through D386 to the base of Q305. If Pin 25 of IC103 is high, Q306 will turn on and ground the path through D386 to the base of Q305. Positive voltage applied through D386 to the base of Q305 turns Q305 on which connects a 150K resistor in parallel with the 1M resistor to ground from the Brush Length Control Line. This causes the .27 uf capacitor, at the base of the Brush Keyer Q342, to discharge faster giving a shorter brush length at the timing points when Q305 is on.

Q305 BRUSH LENGTH REGULATOR

This transistor is only enabled when a rhythm having more than one brush length is on. It is turned on from several decoder circuits depending on the rhythm selected. When Q305 turns on, it connects a 150K resistor to ground from the Brush Length Control Line. This shortens the discharge time of the .27 uf capacitor at the base of the Brush Keyer Q342, thereby creating a shorter brush length.

CYMBAL LENGTH CONTROL
[See Cymbal Keying]

The rhythms using the Cymbal voice are Ballad, Swing March, Waltz, Rock I, II and HI, Samba, Swing, Dixie and Bosa Nova. The length of the Cymbal voice for these rhythms is regulated by varying the discharge rate of the .27 uf capacitor at the base of the Cymbal Keyer Q345. Turning on one of these rhythm selector switches, except Waltz, Dixie or Swing, connects a resistor to ground from the on of the selector switch to the Cymbal length control line. The value of resistance regulates the discharge rate of the .27 uf capacitor thereby regulating the length of the Cymbal voice. (The Waltz rhythm has a long Cymbal voice and no resistor is connected to ground from the Cymbal length control line when this rhythm is turned on). The length of the Cymbal voice for Dixie and Swing is regulated by the Dixie and Swing Cymbal length regulator. Turning on one of these rhythms enables the Dixie and Swing Cymbal decoder which will allow a positive voltage to reach the base of the Cymbal Length Regulator Q308, connecting a 150K resistor to ground from the Cymbal Length Control Line. This causes the .27 uf capacitor to discharge faster giving a shorter Cymbal voice for the timing point when Q308 is on.

Q307, Q308 DIXIE, SWING CYMBAL DECODER & LENGTH REGULATOR

Turning on the Dixie or Swing rhythm allows positive voltage to pass through Diode D346 or D347 (shown on Drawing 14) to the collector of Q307. If Pin 25 of the ROM IC103 is low, this positive voltage passes to the base of Q308 and turns it on. When Q308 turns on, it connects a 150K resistor from the Cymbal

length control line to ground. This causes the .27 uf capacitor at the base of the Cymbal Keyer Q345 to discharge faster, thereby giving a shorter Cymbal length when Q308 is on. When Pin 25 of IC103 is high, Q307 turns on and grounds the base of Q308, turning it off.

Q309, Q310 GENIE MODULATOR KEYER & DRHTER

Turning on the rhythm allows Q309 to be turned on by negative pulses from Pin 23 of IC103. When Pin 23 of IC103 goes low, Q309 conducts and charges the .27 uf capacitor at the base of Q310. When Q309 turns off, this capacitor discharges onto the base of Q310 and turns it on. This applies a positive voltage pulse to Pin 5 of IC55 and gates the input signal through IC55 for the duration of the discharge time. The discharge time of the .27 uf capacitor is controlled by the state of IC103 Pin 25. If Pin 25 is high, the .27 uf capacitor will discharge slowly, holding Q310 on longer thereby creating a long signal pulse. If Pin 25 is low, the .27 uf capacitor will discharge faster through Diode D349 holding Q310 on only for a short time, creating a short signal pulse.

INTRO

The Intro switch is a momentary switch which activates the Intro Latch circuit. With the Intro Latch on, positive voltage appears at the collector of Q322. This voltage disables the rhythm strobe and also (depending on the rhythm selected) enables either the Intro 1 or 2 Strobe Keyer. The outputs of the Intro 1 and 2 Strobe Keyers are connected to the ROM where they perform the same function as the rhythm strobe - (see Circuit Description for Rhythm Strobe). Turning on the Waltz or Swing Waltz rhythm selector switches removes the positive voltage from the "on" of the Intro switch by applying a ground via the Intro disable line. This disables the Intro on these two rhythms.

Q319, Q320 INTRO LATCH

Pressing the Intro switch momentarily applies a positive voltage to the base of Q320 turning it on. When Q320 turns on, it lowers the voltage on the base of Q319. This causes Q319 to turn on which reapplies voltage to the base of Q320 and holds it on. These two transistors remain latched in this manner for the duration of the Intro set. With Q320 held on, a positive voltage is applied to the base of the Intro Switcher Q321, and also to the bases of Q283, Q284 and Q285 disabling the Strum, Arpeggio and Boogie Bass Triggers (see Drawing 14).

Q321 INTRO SWITCHER

Positive voltage from Q320 is applied to the base of Q321 causing Q321 to turn on. When Q321 turns on, it performs two functions: 1) It lowers the voltage on the base of the Intro Enable Q322 turning it on, and 2) It momentarily lowers the voltage on the base of the Intro Reset Q296, via the Intro Clock Reset Line, and turns it on. At the end of the Intro set, the collector of Q321 goes positive and applies a positive pulse through Diode D406 to the base of the Reset Inverter Q299. This causes Q299 to conduct which applies a negative pulse to Pins 3, 5 and 6 of the counter. This resets the counter and insures that the rhythm will start at the first timing point.

Q296 INTRO RESET

The voltage on the base of Q296 is lowered when the Intro Switcher Q321 turns on. This causes Q296 to momentarily conduct bypassing Clock Transistor Q297 and resetting the collector of Q297 to a positive output for the start of the Intro.

Q322 INTRO ENABLE

When the Intro Switcher Q321 conducts, the voltage on the base of Q322 is lowered, causing it to turn on. When Q322 turns on, it performs four functions: 1) It provides the voltage supply for the Intro 1 and 2 Strobe Enable circuits; 2) It applies voltage to the base of Q300, lighting the Intro Lamp; 3) It applies a positive pulse through Diode D407 to the base of Q299, causing Q299 to conduct. This creates a negative pulse on Pins 3, 5 and 6 of the Counter IC102 resetting the counter for positive output for the start of the Intro, and 4) It neutralizes the 10K load through Diode D413, causing the voltage to rise on the base of the Rhythm Strobe Disable Q328.

Q328 RHYTHM STROBE DISABLE

When the Intro Enable Q322 conducts, it applies positive voltage through Diode D413 which neutralizes the 10K load there. This causes the voltage to rise on the base of Q328 which turns it off. When Q328 turns off, it removes the voltage supply to the Rhythm Strobe Transistor Q329, disabling the rhythm strobe pulse.

Q326, Q327 INTRO 1 STROBE ENABLE & STROBE KEYER

The Intro 1 strobe is used for Intro on all rhythms except triplet rhythms. With a rhythm on that is not a triplet, the positive voltage from the Intro Enable Q322 is applied to the base and emitter of Q326. The base voltage will be lower because of the 10K load through Diode D418 and Q326 will conduct and supply positive voltage to two places: 1) Through Diode D420 and a 3.3K resistor to the Clock

Multi-vibrator. This slows down the clock for the Intro set and 2) Through Diode D421 to the emitter and base of the Intro 1 Strobe Keyer. Each time the output from the Strobe Driver Q292 is low, Q327 will conduct, producing a strobe pulse at its collector. This pulse is then connected to Pin 13 of the ROM and performs the same function as the rhythm strobe. (See Rhythm Strobe circuit description.)

Q323, Q324 INTRO 2 STROBE ENABLE AND STROBE KEYER

The Intro 2 strobe is used for Intro on triplet rhythms. With a triplet rhythm on, ground is applied to Diode D415 via the triplet enable line. This causes the voltage from the Intro Enable Q322 to be applied to the base and emitter of the Intro Strobe Enable Q323. The base voltage will be less than the emitter voltage and Q324 will turn on and apply positive voltage to three places: 1) Through Diode D417, neutralizing the 10K load there and preventing a voltage drop on the base of Q326 which keeps Q326 from conducting, thereby disabling the Intro 1 Strobe; 2) Through Diode D416 to the emitter'of the Ballad, Intro Clock Slow Down Switcher Q312 and 3) To the emitter and base of the Intro 2 Strobe Keyer. Each time the output from the Strobe Driver Q276 is low, Q324 will conduct, producing a strobe pulse at its collector. This pulse is then connected to Pin 14 of the ROM and performs the same function as the rhythm strobe. (See Rhythm Strobe circuit description.)

Q312 BALLAD, INTRO CLOCK SLOW DOWN SWITCHER

This transistor is only used when the Ballad Rhythm is on and the Intro tab is activated. Positive voltage is supplied to the emitter of this transistor from Q323 through Diode D416. With the Ballad rhythm selector switch on, ground is applied to Q312's base via the Ballad Intro Slow Down Enable Line. This lowers the voltage on the base of Q312 and turns it on. When Q312 turns on, it applies positive voltage through a 2K resistor to the Clock Multi-Vibrator and slows down the clock for this Intro set.

Q318 INTRO END SWITCHER

At the end of the Intro sequence Pin 14 of the Resetable Counter IC102 goes low, momentarily lowering the voltage on the base of the Intro End Switcher Q318. This turns on Q318 which applies positive voltage to the base of Intro Latch Transistor Q319. This turns off Q319 which removes positive voltage from the base of Latch Transistor Q320 which also turns off. This removes positive voltage from the base of the Intro Switcher Q321 and it turns off, removing the load from Intro Enable Q322 which also turns off. When Q322 turns off, the 10K load through D413 is no longer neutralized and a voltage drop results on the base of Q328 Rhythm Strobe Disable. This causes Q328 to turn on, supplying voltage to the Rhythm Strobe Transistor Q329 and the rhythm voice resumes playing.

Q315 INTRO HOLD RESET

The Intro Hold Reset only functions when the Intro Switch is being held on or is pressed directly after the Intro set. Positive voltage is applied to the collector of Q315 from the Intro Switch, but Q315 is held on during the Intro set by positive voltage from Pin 14 of IC102 causing its collector to be at a low level. At the end of the Intro set, Pin 14 makes a negative transition turning off Q315 which applies a positive voltage to reset Inverter Q299. This resets the Counter IC102 back to the first timing point for the next Intro set.

NOTE: This reset makes it possible to play two or more Intro sets in succession. If the Intro switch was held on and this reset failed to function, a dead measure would exist between Intro sets.

SCHEMATIC 16

INSTRUMENTATION

The Instrumentation circuits produce the instrument voices for the rhythm. The generator circuits are tied together at their output and applied to the rhythm preamp where the voices are amplified and sent via the rhythm volume control to the Main Volume Regulator.

IC107, IC108, IC109 RHYTHM GENERATORS

The Rhythm Generators are tuned resonant circuits. Pulses from the Rhythm Function Generator cause the circuits to generate short bursts of audio oscillation with diminishing amplitudes. The outputs of the Rhythm Generators are combined and applied to the Rhythm Preamp IC107D.

IC110 NOISE GENERATOR

The Noise Generator produces a random noise signal which is applied to the cathode of Diodes D484, D485 and D486. When the Snare, Brush or Cymbal Keyer circuits operate, this signal is passed through D484, D485 or D486 to the Cymbal, Brush or Snare Voicing circuits.

CIRCUIT DESCRIPTION

Q339, Q340, Q341 SNARE KEYER, SNARE VOICING

Pulses from Pin 6 of IC103 or the manual rhythm are applied to the High Drum Generator and through Inverter IC106D to the Low Drum Generator and Snare Keyer circuits. The pulses cause the High and Low Drum Generators to oscillate producing the High and Low Drum voices. These audio signals are then combined and routed to the rhythm preamp. Pin 2 of IC106D also applies a positive pulse to the base of Q339, Snare Keyer, turning it on. This causes positive voltage to turn on Diode D484 which allows noise signal to pass to the Snare Voicing circuit Q340 and Q341 where it is voiced for proper tonality. The voiced noise signal at the output of Q341 combines with the High and Low Drum signals, together creating the Snare Drum voice.

Q342, Q343, Q344 BRUSH KEYER, BRUSH VOICING

Pulses from Pin 21 of the ROM IC103 are inverted by IC106E and applied as positive pulses to the base of Q342, Brush Keyer, turning it on. This applies positive voltage to Diode D485 which now conducts allowing noise signal to pass to the Brush Voicing circuit. Here the signal is voiced for proper Brush tonality then applied to the Rhythm Preamp IC107D. With each positive pulse applied to Q342, a .27 uf capacitor is charged. The length of the Brush tone is regulated by varying the discharge time of this capacitor through Brush Length Regulator Q305 (see Schematic 15).

Q345, Q346, Q347 CYMBAL KEYER, CYMBAL VOICING

Pulses from Pin 7 of ROM IC103 are inverted by IC106F and applied as positive pulses to the base of Q345, Cymbal Keyer, turning it on. This applies positive voltage to Diode D486 which now conducts allowing noise signal to pass to the Cymbal Voicing circuit. Here the signal is voiced for proper Cymbal tonality then applied to the Rhythm Preamp IC107D. With each positive pulse applied to Q345, a .27 uf capacitor is charged. The length of the Cymbal tone is regulated by varying the discharge time of this capacitor through Cymbal Length Regulator Q308 (see Schematic 15).

IC107D RHYTHM PREAMP

Audio signals created by the Instrumentation circuits are applied to the Rhythm Preamp IC107D where the signal is amplified before being applied to the Rhythm Volume Control. The signal is then applied to the Main Volume Regulator.

MANUAL RHYTHM

Using the Manual Rhythm permits several of the Rhythm Instrumentation voices to be controlled independently of the ROM IC103. At keydown, voltage from the Lower Keyboard Keyswitches is developed into a trigger pulse by the Lower Keyboard Manual Rhythm Trigger Q337 and applied to the Snare Drum Switcher Q336 and the Noise Keyer Q348 via the Manual Rhythm pushbuttons. Pulses from the Pedal Cancel Trigger are used for the Bass Drum and Cymbal. Pedal keying voltage is applied to the Pedal Brush Shimmer Generator Q338 and through the Brush pushbutton to Noise Keyer Q348. The Snare and Bass Drum Switchers trigger instrumentation generators which develop the proper drum tone and applies this audio to the Rhythm Preamp IC107D. The Noise Keyer Q348 is common to the Cymbal and Brush switches. When Q348 is keyed, noise is applied to a voicing circuit where it is voiced and then routed to the Rhythm Preamp.

Q337 LOWER KEYBOARD MANUAL RHYTHM TRIGGER

The input to Q337 is connected to the Lower Keyboard Keyswitch Buss (C1-C4). With no keys depressed, a 24-volt potential is felt at the input of the .05 uf capacitor. At keydown, this voltage is lowered, developing a negative pulse across the .05 uf capacitor. This turns off Q337 and applies a positive pulse to the Cymbal Length Switcher Q335 and through switches to the Snare Drum Switcher Q336 and Noise Keyer Q348.

Q336 SNARE DRUM SWITCHER

A positive pulse from Q337 to the base of Q336 momentarily turns on Q336 which applies a low to the circuitry associated with the Snare Drum. The voicing for the Snare Drum is developed as described above for Q339, Q340, Q341 Snare Keyer and Voicing. Note that the Snare Cancel Switch will affect the Manual Rhythm Snare Drum.

Q348, Q349, Q350 NOISE KEYER AND VOICING

A positive pulse from Q337 is routed 1) through D462, D463 and the Cymbal switch and 2) through D462, D464 and the Brush switch to the base of Q348. This voltage turns on Q348 which applies a positive voltage to Q349 and forward biases Diode D487 which applies random noise to the Noise Voicing transistors Q349 and Q350 where the signal is voiced and amplified for proper tonality. The signal then passes to Rhythm Preamp IC107D.

NOTE: The Cymbal and Brush will have an identical tone and length when triggered from the lower manual.

CIRCUIT DESCRIPTION

Q332 BASS DRUM SWITCHER

Each time a bass pedal is pressed, a pulse is developed across a .22 capacitor (see Schematic 10). This momentarily lowers the voltage on the base of Pedal Cancel Trigger Q161 turning it off. A positive pulse is applied to the base of Q332. This turns on Q332 momentarily lowering the voltage at its collector which applies a low to the Inverter IC106A. IC106A outputs a positive pulse to the Base Drum Generator which develops the Bass Drum tonality.

Q333, Q334, Q335 PEDAL CYMBAL LENGTH REGULATOR & SWITCHERS

When a pedal is pressed, 1) A positive pulse is applied to the base of Q333 turning on Q333 and applying a positive pulse to the Noise Keyer Q348; 2) The pedal pulse is also routed through D461 and D463 to Q348 to give the Cymbal a slight accent at pedal keydown and 3) A DC voltage is applied from the Pedal Keydown Detector Q163 (see Schematic 10) to the base of Q335 turning on Q335 which holds Q334 off. When the pedal is released, the base of Q334 is ungrounded and positive pulses from lower keyboard Manual Rhythm Trigger Q337 will now reach the base of Q334. A pulse from Q337 will turn on Q334, momentarily grounding the base of Q333 which prevents the Pedal Cymbal from sustaining.

Q338 PEDAL BRUSH SHIMMER GENERATOR

Pressing a pedal applies DC voltage to the collector and base of Q338 turning it on. Audio signal from the D#3 (155 Hz) and E3 (164 Hz) is hetrodyned by Q338 and applied to a filter circuit. The filter removes all but the 9 Hz frequency. This is routed through D465 and the Brush switch to the Noise Keyer, modulating the noise.

SCHEMATIC 17

ORCHESTRAL SYMPHONIZER LATCH

IC113, IC114 8-BIT PRIORITY ENCODER

The primary function of the priority encoders is to provide a binary address for the active input with the highest priority. The order of priority is from top to bottom as shown on Schematic 17. The least significant bit appears at Pin 9 and the most significant bit at Pin 14. Pin 14 is normally low and goes high when a preset switch associated with IC113 is on. Pin 15 is normally high and goes low when an input is active. Pin 15 of IC113 is connected to Pin 5 of IC114. When there is an active input to IC113, Pin 15 goes low disabling IC114. Pin 15 of IC114 will also go low at this time. The priority encoders only have an output when a preset switch is on. Since the switches are momentary, the binary output from the encoders is only present while the preset button is being held. The binary output is then applied to the latch circuit.

IC115-IC119 ORCHESTRAL SYMPHONIZER LATCH

The latch circuit consists of IC115-IC119. Its function is to enable the Decoder IC120 and latch the binary address from the encoders into Decoder IC120. The latch circuitry will cancel a previously on preset by pressing a new preset or cancel a preset by repressing the same preset button.

ACTIVATING A NEW PRESET

Pressing a new preset switch applies a binary address corresponding to the preset switch being held, from the encoders to the D inputs of IC115 and IC116. If at least one of the D inputs is at a different level from the Q outputs, then one or more of the exclusive OR gates IC117 A-D will go high. This high level is inverted through IC118D and disables Latch Cancel Counter IC119B. (When a preset switch is pressed, Pin 15 of IC114 goes low, applying the low to the Reset inputs of IC119A&B. IC119A&B will count when the Reset input is low and the Enable input is high.) Initially, the Q outputs of IC119A&B are low. The Q outputs are applied as inputs to Counter Enable IC118C. Since both inputs to IC118C are low, the output of IC118C is high which enables IC119A. After eight positive transitions of the clock (220 Hz from A Divider) are applied to Pin 9 of IC119A, the Q output Pin 14 goes high. The Q output from IC119A is applied to the clock inputs of the Latch Flip-Flops IC115 & IC116, transferring the binary address at the D inputs to the Q outputs and to the inputs of the Decoder IC120. This binary address causes one of the Decoder outputs (Pins 1-11, 13-17) to go low activating a new preset voice. The Q output from IC119A is applied to IC118C and IC118D. Any high applied to a NOR gate applies its output low. This low disables IC119A&B and locks it in its present state until the active preset button is released which resets the Q outputs of IC119A&B low.

CANCELLING A PRESET

If the preset switch that was activated is pressed again, the binary address at the D inputs of IC115 and IC116 will be identical to the binary address latched at the Q outputs. Both inputs to each exclusive OR gate will be at the same level causing the outputs to be low. This low is inverted by IC118D and enables IC119B. After four positive transitions

of the clock (220 Hz from A Divider), the Q output of IC119B goes high. This high is inverted through IC118C and disables IC119A. The Q output from IC119B is also applied to Latch Cancel IC118B. Any high to a NOR gate applies its output low. This low is applied to the reset inputs of IC115 and IC116, resetting the Q outputs low. This cancels the preset.

IC120 DECODER

The binary address from the latch circuit is applied to the decoder where it generates one of sixteen outputs. The decoder outputs are normally high and go low when active. Pressing a preset switch applies a low to the output pin corresponding to the active input of the encoders. This enables the lamp driver and DC switcher circuits.

Q353-Q367 LAMP DRIVERS AND DC CONTROL SWITCHERS

The low output from the active decoder line is applied to the base of a lamp driver and DC control switcher turning on this PNP switcher. When the switcher turns on, it lights the preset lamp at its collector and also applies positive voltage to various control circuits which give the character to the voice chosen.

Q368-Q382 SWITCHER DRIVERS

The low output from the active decoder line is applied to the base of a switcher driver transistor, causing it to turn off, which applies positive voltage to the FET switchers associated with the selected voice. This allows the audio signal from the various voicing circuits to pass to the power amplifiers. Some switcher enablers also apply voltage to the base of an orchestral chorus switcher.

Q383, Q384, Q385 ORCHESTRAL CHORUS SWITCHERS

Some of the Orchestral Symphonizer voices have a chorus effect. With one of these voices on, a positive voltage is routed to the base of the Orchestral Chorus 1, 2 or 3 Switcher. This turns on the chorus switcher enabling the chorus circuitry and regulating the amount of chorus for the voice chosen.

SCHEMATIC 18

Q389, Q391 ORCHESTRAL SYMPHONIZER KEY-DOWN DETECTOR DRIVER & ENABLE

Turning an Orchestral Symphonizer preset on applies a low through D541 to the base of Q389. Q389 turns off which allows Q391 to turn on, supplying the keying voltage to the Orchestral Symphonizer keyswitch and keydown detector. If a brass preset is on, the output from the vibrato oscillator is allowed to pass to the base of Q389. This fluctuates the keying voltage and gives a tremolo effect to the brass voices.

Q390 PIANO, GUITAR KEYING VOLTAGE SWITCHER & GUITAR TREMOLO CANCELLER

Turning on a Piano or Guitar preset applies positive voltage to the base of Q390, turning it on. When Q390 turns on it ensures that Q389 is fully off, giving a maximum collector voltage which in turn gives a maximum keying voltage at the emitter of Q391 for the percussion type voices. Q390 also cancels the tremolo effect for the Guitar presets but vibrato can still be used with these presets. With a Piano preset on the vibrato oscillator is disabled, cancelling the tremolo effect for the presets and also the vibrato effect on all voices.

Q392 LOW VOLTAGE KEYING SWITCHER

Turning on the Clavecin, Oboe, Saxophone or Krumet voices turns on Q392 by applying a positive voltage to its base via the low voltage keying line. This lowers the base voltage on Q391 which in turn lowers the Orchestral Symphonizer keying voltage for the above-mentioned voices.

NOTE: The normal keying voltage of approximately 40V is reduced to approximately 10V when Q392 is turned on.

Q393 ORCHESTRAL SYMPHONIZER KEYDOWN DETECTOR

With an Orchestral Symphonizer preset on, positive voltage is applied to the base and emitter of Q393. Pressing a keyswitch at this time causes Q393 to conduct, applying positive voltage to two circuits: 1) This voltage is applied as a pulse to the Master Oscillator when Detuning Pulse Switcher Q394 is off; and 2) To the cathode of D544 enabling the Trumpet Mute Driver circuit.

Q394 DETUNING PULSE SWITCHER

Turning on any one of the following voices, Classic Guitar, Electric Guitar, Clavecin or Honky-Tonk lowers the voltage on the base of Q394 via the detuning pulse enable line. This causes Q394 to turn off allowing a pulse from the keydown detector to pass to the Master Oscillator Q8. This pulse momentarily detunes the Master Oscillator at keydown for the above-mentioned voices.

CIRCUIT DESCRIPTION

Q395-Q397 TRUMPET MUTE DRIVER & SHAPERS

Q396 is biased on slightly. The path for its collector voltage before keydown is through Diode D544. At keydown D544 becomes reverse biased by the collector voltage now present from Q393. At this time, the .1 capacitor at the collector of Q396 begins to charge. As the capacitor charges, the emitter voltage of Q397 begins to rise and Q395 begins to turn on. This lowers the base voltage on Q396 which turns on harder, causing a rise in Q397's emitter voltage which is again applied back to the base of Q395. Q395 turns on harder and the emitter voltage of Q397 continues to rise. This causes an exponential voltage rise at the emitter of Q397. The voltage continues to rise in this manner until Q395 saturates causing the emitter of Q397 to reach its maximum DC level. This waveform is applied to the Trumpet Mute filter and gates the audio signal through the filter at the amplitude of the waveform.

Q404, Q405 ORCHESTRAL SYMPHONIZER KEYER & PULSE KEYER

There are 61 upper keyboard orchestral keying circuits; one of which is shown on Drawing 18. Pressing a keyswitch with an Orchestral Symphonizer preset on applies positive voltage to the base of a Q404 through either the Brass or Piano/Guitar keying line. Only one of these keying lines can be enabled at any one time. The amplitude of keying voltage through the Brass keying line is such that Capacitor C2 charges relatively slow. This produces a steadily rising voltage at the emitter of Q404, causing the 330K resistor and capacitor C3 to charge to a changing reference. On initial keydown, this will cause the output of Q405 to vary from a wide pulse width of small amplitude to a narrow pulse width of higher amplitude and creates the breathy keydown effect for the Brass voices. After the emitter of Q404 reaches its maximum DC level, the output of Q405 will be a pulse waveform with approximately a 10% duty cycle at the frequency of the input signal. The output of Q405 then passes through Diode D559 where it is separated into groups and routed to various filtering circuits. With a Brass voice on, the sustain line is grounded and releasing the key causes any remaining capacitor charge to discharge through a D556 and a 120K resistor to ground. The keying voltage through the Piano/Guitar keying line is of a higher amplitude and is applied as a pulse to the base of Q404. This causes the emitter of Q404 to go to its maximum voltage at keydown creating a positive pulse at the collector of Q405. This pulse is routed through D558 to the strike tone amp and creates the percussive keydown effect for the Piano, Guitar and Banjo/Mandolin presets. Also, the emitter voltage from Q404 biases on Diode D560 allowing audio signal to pass to the sawtooth filtering groups. If the key is held down, the decay time of this pulse is determined by voltage on the snub line through Diode D557. After the snubbing, the remaining capacitor voltage holds on Q404 for the duration of its discharge time. If the key is released before the decay is complete, the capacitor discharges through Diode D556, a 120K resistor and Q402 to ground. (This discharge path is blocked as long as a key is being held because of the reverse bias condition of D556.) If a Piano preset is on, the glide switch becomes a sustain switch. Hitting the glide switch after the key is released, applies positive voltage to the base of Q402. This causes Q402 to turn off which removes ground from the 61 note sustain line. This causes C2 to discharge onto the base of Q404, holding it on and creating a sustain effect.

Q406, Q407 ORCHESTRAL SYMPHONIZER PEDAL KEYER & PULSE KEYER

With an Orchestral Symphonizer preset on, positive voltage is applied to the emitter and base of Q171 (see Schematic 10). If the Orch to Pedal tab is on and a pedal is pressed, a positive voltage is applied to the base of Q172, turning it on which in turn causes Q171 to turn on. This applies a positive voltage through either the pedal brass keying line or the pedal Piano/Guitar keying line to the base of Q406 Orchestral Symphonizer pedal keyer.

The Orchestral Symphonizer Pedal Keyer circuit is identical in operation to the 61 upper keyboard Orchestral Symphonizer circuits. See Q404 and Q405 for circuit description.

Q398 PIANO SNUB & BRASS DISABLE SWITCHER

Turning on an Orchestral Symphonizer Piano preset applies positive voltage to the base of Q398. This turns Q398 on and performs two functions: 1) it provides a ground for the voltage divider (12K, D545 and the 1.5K) which develops the voltage for the snub line and 2) the Brass keying line is grounded through Diode D546 disabling this keying line when a Piano preset is on.

Q399 GUITAR SNUB & BRASS DISABLE SWITCHER

Turning on an Orchestral Symphonizer Guitar preset applies a positive voltage to the base of Q399. This turns Q399 on and performs two functions: 1) it provides a ground for the voltage divider (12K, D547 and the 1.8K) which develops the voltage for the snub line and 2) the Brass keying line is grounded through Diode D548 disabling this keying line when a Guitar preset is on.

CIRCUIT DESCRIPTION

Q400 PIANO & GUITAR DISABLE SWITCHER
Turning on an Orchestral Symphonizer Brass preset applies positive voltage to the base of Q400 turning it on. When Q400 turns on it grounds the Piano/Guitar keying line disabling this keying line when a Brass preset is on.

Q403 SUSTAIN CANCEL SWITCHER
Turning on a Brass or Guitar Orchestral Symphonizer preset applies positive voltage to the base of Q403 turning it on. When Q403 turns on it grounds the Orchestral Symphonizer sustain line, cancelling sustain for the Brass and Guitar presets.

Q401 GLIDE CANCEL SWITCHER
Turning on an Orchestral Symphonizer Piano preset applies positive voltage to the base of Q401 turning it on. When Q401 turns on it grounds the input to the glide circuit cancelling glide. Pressing the glide switch at this time applies positive voltage to the sustain line. This blocks the discharge path through D556 and Q402 and gives a sustain effect to the Piano presets.

SCHEMATIC 19

ORCHESTRAL SYMPHONIZER QUALITY CONTROL

Audio signal from the pulse keyer and sawtooth keying circuits is separated into groups and routed through various filtering circuits where the tonal quality of each voice is created. The strike tone pulse is routed through IC130A where the length of this pulse is determined by regulating the DC level at Pin 3. The pulse is then filtered and used with the percussive voices of the Orchestral Symphonizer. Turning on a preset applies positive voltage from a Switcher Driver Transistor to one of the FET switchers turning it on, which allows the audio signal to pass to one of the volume regulators.

IC133, IC134, Q421, Q422 TRUMPET MUTE FILTER
This circuit is a State Variable Filter that acts in conjunction with the 800p capacitors to form an RC Low Pass filter. Signal from the Trumpet Filter is gated through the filter at the amplitude of the drive waveform applied to Pins 5 of IC133 and IC134. The output is a low impedance signal that is routed to the Chorus Channel Volume Regulator IC136 when the Trumpet Mute preset is on.

IC131B, IC135, Q429 ORCHESTRAL SYMPHONIZER MAIN CHANNEL MIXING PREAMP, VOLUME REGULATOR & EMITTER FOLLOWER
Audio signal components of the active Orchestral Symphonizer preset are mixed and amplified by IC131B. The output of IC131B is routed to the input of the Orchestral Symphonizer Chorus circuit and also to Regulator IC135. The amplitude of the voltage applied to Pin 5 of IC135 from the Orchestral Volume Control VR51 regulates the amplitude of ICl35's output signal. This signal is then passed through Q429 where it is transformed into a low impedance signal before being routed to the Main Mixing Preamp. The signal that is routed to the chorus circuit is phase modulated and applied to the input of the Chorus Channel Volume Regulator IC136.

IC136, Q430 ORCHESTRAL SYMPHONIZER CHORUS CHANNEL REGULATOR & EMITTER FOLLOWER
Audio signal from the Orchestral Symphonizer Brass voices is applied to IC136 where the amplitude of the output signal is determined by Orchestral Symphonizer Volume Control VR51. Phase modulated audio signal from the Orchestral Symphonizer Chorus circuit is also routed through IC136. These signals are then applied to Q430 where they are transformed into a low impedance signal before being routed to the Reverb Circuit and Phase 2 and 3 Volume Regulators.

SCHEMATIC 20

ORCHESTRAL SYMPHONIZER CHORUS

Q434, Q435 & Q436 CHORUS ENABLE AND DEPTH REGULATORS
Turning on an Orchestral Symphonizer preset that has a chorus effect applies positive voltage through Diodes D604, D605 or D606 to the emitter of Q434. This turns Q434 on and effectively grounds Pin 9 of IC139 enabling the Chorus Speed Oscillator. Q435 and Q436 regulate the amplitude of the oscillator output by regulating the amount of shunt resistance at the output of the oscillator. Q435 and Q436 are normally saturated. This is the condition when a preset using Chorus 1 (Grand Piano, Harpsichord, Clavecin, Electric Guitar) is on. With Q436 saturated, Q435 has no effect on the circuit and the oscillator output sees a IK resistor to ground through Q436. (The + 11.4V supply appears as a ground to the oscillator output.) This condition gives the least chorus effect. Turning on the Classic Guitar preset which uses Chorus 2, applies positive voltage

through Diode D601 and shuts off Q436. The oscillator output now sees an 11K shunt resistance through Q435. This gives a slightly greater chorus effect for Classic Guitar. With the Honky-Tonk, Carillon or French Horn presets on, positive voltage is routed through Diodes D601 and D603, turning off both Q435 and Q436. This removes the shunt from the oscillator output, allowing it to be at its maximum amplitude. This gives a maximum chorus effect to the presets using Chorus 3. At this time the 20 uf capacitor is referenced through the series combination of a IK, 10K and 470K resistors to + 11.4 volts.

IC139C&D AND Q437 & Q438 CHORUS SPEED AND VOLTAGE-CONTROLLED OSCILLATORS

When the Chorus Speed Oscillator is enabled, it produces a .7 Hz triangular waveform at the output of IC139D. The amplitude of this waveform is Regulated at the output of IC139D before being routed to the voltage controlled oscillator. The voltage controlled oscillator runs at a speed which is inversely proportional to the amplitude of the input from the speed oscillator. Since the amplitude of the input from the speed oscillator is constantly changing, the frequency of the voltage controlled oscillator varies. This in turn varies the delay time of the audio signal through the bucket brigade resulting in a phase modulated signal.

IC139A INPUT LOW-PASS FILTER

The input Low-Pass Filter prevents intermodulation by filtering out certain high frequency signals. The output of this filter is then applied to the input of the bucket brigade.

IC140 BUCKET BRIGADE

The Bucket Brigade is an analog shift register which samples the input audio signal at the rate of the Clock pulses from the Voltage Controlled Oscillator. Each time a negative clock pulse is applied to Pin 2 and then Pin 12 of IC140, the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output at Pin 14. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The audio signal output from the Bucket Brigade is then applied to the low pass filter.

IC139B OUTPUT LOW-PASS FILTER

The output Low-Pass Filter filters out the high frequency clock component that is contained in the audio signal at the output of the Bucket Brigade. This phase modulated signal is then routed through the Chorus Channel Volume Regulator and Emitter Follower to the Phase 2 and 3 Power Amplifiers.

SCHEMATIC 21

CARILLON KEYING & FILTERING

The Upper Keyboard C4 through C6 (Lower C3-C5) keyswitches are used to key the Carillon preset. Each Carillon note is a combination of four pitches. The signals are collected and filtered before being routed to the Carillon Mixing Preamp,

The C6 Keyer is used for the following example. When the Carillon preset is on, the Piano/Guitar Keying Line is active. Pressing the C6 Keyswitch applies a positive pulse from the emitter of the Orchestral Symphonizer Keyer (see Schematic 18) to the base of Carillon Keyer Q447. Q447 turns on momentarily applying a positive pulse to four signal diodes D619. The four audio signals are the 2-, 2-2/3-, 4- and 6-2/3-foot pitches (C8, G7, C7 and E6 octave frequencies). The signals are applied to the Carillon filters. The outputs of the filters are routed to the Carillon Mixing Preamp (Summing Amplifier, unity gain) shown on Schematic 19.

The positive pulse applied to the base of Q447 charges a .33 uf capacitor. After the keying pulse occurs, the capacitor discharges to the voltage level on the 25-note snub line. The remaining voltage discharges onto the base of Q447 giving sustain to the Carillon preset.

SCHEMATIC 22

GOLDEN HARP

IC148B & IC150B HARP SPEED OSCILLATOR

The Harp Speed Oscillator produces a symmetrical square wave output at Pin 11 of IC150B. The frequency of this output is adjustable from 3 to 20 Hz by the Harp Speed Control VR60. If the Rhythm Sync Switch is on and a rhythm is on, Pin 1 of IC148B is held high, disabling the Harp Speed Oscillator. At this time the rhythm clock output is routed through Diode D721 to the scan oscillator and the speed of the Harp is controlled by the rhythm. If the Rhythm Sync Switch happens to be on and no rhythm is on, the input from the rhythm clock at the anode of D721 is reset to a low level and Pin 1 of IC148B is grounded through the Rhythm On Switcher Q283. This enables the Harp Speed Oscillator which now has an output through Diode D720 and D722 to the Scan Oscillator.

CIRCUIT DESCRIPTION

Q469 HARP FOOTSWITCH ENABLE

The Golden Harp and the Magic Chord Minor Enable are activated from the same footswitch. When the Magic Chord tab is off, a positive voltage from Q280 turns on Q469 applying positive voltage via Diodes D714 and D724 to Pin 8 of IC148C disabling the Scan Oscillator. When the Minor/Golden Harp Footswitch is activated, the emitter voltage is grounded through D713. If a lower keyswitch is pressed, Q244 turns on which provides a low enable for the Scan Oscillator. With the Magic Chord tab on, Q469 is turned off removing this DC voltage from the Harp Enable line. Positive voltage is applied through the Golden Harp tab and D715 to the Harp Enable line, disabling the Scan Oscillator. If the Golden Harp tab is placed to the on position, the positive voltage is removed from the Harp Enable line. Pressing a Magic Chord keyswitch will apply AOC Data from the Magic Genie AOC Decoder to the AOC Drivers. Q244 will be turned on applying a low to the Scan Oscillator. The Golden Harp circuit will continue to play as long as AOC Data is being applied to the AOC Drivers.

IC148C & IC148D SCAN OSCILLATOR

To enable the Scan Oscillator, the following conditions must be met: 1) the Q output of IC152A must be low, 2) a low is applied to D722 from the Inverter or the Rhythm Clock, 3) the Minor/Golden Harp Footswitch is activated and 4) a lower keyswitch is pressed. When the inputs to IC148C Pin 8 are low, the Scan Oscillator is enabled. The Oscillator runs at a frequency of approximately 700 Hz producing outputs that are inverted from each other at Pins 10 and 11 of IC148. The output from Pin 10 is applied to Up/Down Counter IC153 and the output from Pin 11 is applied to the Stop Scan Triggers IC151B and the Pulse Swallower Reset IC150C.

IC153, IC154 UP/DOWN COUNTER & DECODER

With a lower keyswitch pressed and the Golden Harp footswitch on, Up/Down Counter IC153 is enabled. The Up/Down Counter advances each time a positive pulse is applied to Pin 15 and generates one of sixteen binary outputs at Pins 6, 11 14 and 2. The least significant bit appears at Pin 6 and the most significant bit at Pin 2. If Pin 10 is held high, it generates a binary up count; if Pin 10 is held low, it generates a binary down count. Applying a positive pulse to Pin 1 resets the counter to its zero count. The output of the counter is applied to the Up/Down Decoder IC154 where it generates one of sixteen outputs. The decoder outputs are normally high and go low when active. They are sequentially enabled. Pin 1 being the lowest count and Pin 17 the highest. Pins 1 or 17 trigger the octave counter, depending on the position of the Down only switch. Pins 2-14 (excluding 12) sequentially enable the 12 Enable Transistors Q473. The outputs on Pin 15 and 16 are not used.

IC151A&B, IC152A STOP SCAN TRIGGERS & STOP SCAN

The Harp Speed Oscillator and Stop Scan circuit work together to control the scan oscillator which in turn is used to generate the stepping pulses for the Up/Down Counter IC153. When the output from the Harp Speed Oscillator, the Q output Pin 1 of IC152A and the Harp Enable and Reset Line are low, the scan oscillator runs producing the stepping pulses for the Up/Down Counter IC153. Applying a pulse to Pin 15 of IC153 causes one of the decoder lines of IC154 to go low. If the lower manual key for that stage is not being held, nothing happens and the scan oscillator continues to oscillate, generating another step on its next cycle which advances IC154 to the next note. If the next note is present from the lower manual, positive voltage is routed through Diode D726 to Pin 8 of IC150C and also to Keyers Q474. On the next half cycle of the Scan Oscillator, Pin 11 of IC148D applies a high to Pin 13 of IC151B. The Q bar output of IC152B is also high, (this Q bar output only changes state when the Counter IC153 is transferring from an up count to a down count or from a down count to an up count) and is applied to Pin 12 of IC151B causing Pin 11 of IC151B to go high. The output from Pin 11 is applied to Pin 9 of IC151A. Pin 8 of IC151A is high due to the active lower manual note. This causes the output of IC151A to go high, clocking Pin 3 of IC152A. The Q output Pin 1 of IC152A now goes high and is applied through Diode D723 to Pin 8 of IC148C. This locks the output of IC148C low and disables the scan oscillator. The stop scan operation has taken place while the output of the Inverter Q470 is still at a low level. On the next half cycle of the Harp Speed Oscillator, Q470 makes a positive transition and resets the Q output of IC152A to a low level. The scan oscillator is still inhibited through Diode D722 due to the high level of Q470. On the next half cycle of the Harp Speed Oscillator, Q470 goes low and the scan oscillator runs again at a rate of 700 Hz and searches for the next active note in the sequence.

Q474 GOLDEN HARP KEYERS

This circuit contains 36 Emitter Follower Keyers Q474. The keyers are arranged in 12 identical circuits, each consisting of 3 keyer transistors. Each of the 12 circuits corresponds to a note in an octave. Each of the 3 keyers in a circuit is associated with a

different octave starting at the first octave and running through the third octave. Up/Down Decoder ICl54 provides enable outputs (low levels) sequentially for each note of an octave. For example, if IC154 Pin 2 is low, C# Enable Q473 is turned off. If at this time the C#l, C#2 or C#3 Lower Manual Keyswitch is pressed, a positive voltage is applied to the 2.2K collector resistor of the C# Enable Q473. The positive voltage is 1) applied through Diode D726 (C# circuit) triggering the stop scan circuitry and 2) routed to the base of the C#l, C#2 or C#3 Keyer Q474, depending on which octave lead is ungrounded at that time. Only one octave lead is ungrounded at any one time. The voltage then turns on Q474 (C# circuit) and keys a note through the Upper Diode Keying circuits.

IC149 & Q472 UP/DOWN COUNT ENABLE GATES & DRIVER

In normal operation (virtuoso off) the output of IC148A Pin 4 is always low. This will cause Pin 11 of IC149C and Pin 8 of IC149D to lock in a high state. Also the low output of IC148A is inverted through IC149A locking Pin 6 of IC149B in a high state. In the up count mode of operation, the base of Q472 is low causing its collector to be high. This high level is applied to Pin 5 of IC149B. Since Pin 6 of IC149B is locked high its output at Pin 4 will be low. Since Pin 8 of IC149D is locked high, its output at Pin 10 will go high. This high output is applied to Pin 10 of IC153 Up/Down Counter, causing it to generate a binary up count. In the down count mode of operation, positive voltage will be routed to the base of Q472, turning it on which puts its collector at a low level. This low is applied to Pin 5 of IC149B. Since Pin 6 of IC149B is locked high, its output at Pin 4 and correspondingly the input Pin 9 of IC149D will go high. Since Pin 8 of IC149D is locked high the output of IC149D will go low. This low level is applied to Pin 10 of Up/Down Counter IC153, causing it to generate a binary down count.

IC150A&C, IC152B PULSE SWALLOWER & RESET

When the count changes direction, the first active note that is found in the new direction will be the same as the last active note played in the old direction. The result would be that the highest or lowest note (depending on the count direction) being held would play twice at the transfer point. The purpose of the pulse swallower circuit is to prevent this condition by not stopping the scan oscillator at the first active note after the transfer.

When there is a count direction change, the collector of Q472 makes a transition from high to low, or from low to high. If the transfer is from an up count to a down count, the collector makes a negative transition which is inverted by ICl50A and applied as a positive pulse through Diode D716 to the set input Pin 9 of IC152B. If the transfer is from a down count to an up count, the collector makes a positive transition which is applied as a positive pulse through Diode D718 to the set input Pin 9 of IC152B. This pulse causes the Q bar output Pin 14 of IC152B to go low. When the first active note after the transition is reached, a positive voltage is routed through Diode D726 to Pin 8 of IC150C. On the next half cycle of the Scan Oscillator Pin 11 of IC148D goes high. This high level is applied to Pin 13 of IC151B, but this gate is now disabled due to the low level at Pin 14 of IC152B. This prevents an output on IC151B which in turn prevents the output of IC151A from going high and clocking Stop Scan Flip-Flop IC152A. Thus the scan oscillator continues to run, bypassing this note in the sequence. On the next half cycle of the scan oscillator Pin 11 of IC148D goes low. This causes the output of the Pulse Swallower Reset IC150C to go high and clock Pin 13 of IC152B. This resets the Q bar output high and enables the stop scan triggers for the next active note in the sequence.

NOTE: Pin 13 of IC152B is clocked each time Pin 11 of IC148D goes low, but because of the condition of the J&K inputs, the same output condition is reinstated. That is, the Q bar output remains high.

IC150D, IC155 & IC156 OCTAVE COUNT TRIGGER, COUNTER & DECODER

The octave counter IC155 advances each time a positive pulse is applied to Pin 15 and is capable of generating one of sixteen binary outputs at Pins 6, 11, 14 and 2. The least significant bit appears at Pin 6 and the most significant bit at Pin 2. The maximum binary count IC155 reaches is 6 in the Up/Down 3 mode of operation. If Pin 10 is held high, IC155 generates a binary up count. If Pin 10 is held low, it generates a binary down count. In normal operation, Virtuoso off, Pin 10 is always high. Applying a positive pulse to Pin 1 resets the counter to its zero count. The output of ICl55 is applied to the octave count Decoder ICl56 where it generates one of ten outputs.

The octave decoder outputs are normally low and go high when active. They are sequentially enabled; Pin 3 being the lowest count and Pin 7 the highest. The count sequence is from top to bottom as shown on Drawing 22. Pins 3, 14, 2, 15, 1 and 6 sequentially enable the octave switcher transistors; Pin 7 is used as the reset pulse in the Up/Down 3 mode of operation. Three of the ten decoded outputs from Pins 4, 9 and 5 are not used.

CIRCUIT DESCRIPTION

When the Up/Down Decoder IC154 reaches its maximum count, Pin 17 (minimum count, Pin 1 in the down only mode of operation) goes low and is inverted through Octave Count Trigger IC150D, applying a positive pulse to Pin 15 of Octave Counter IC155. This advances Counter IC155 which sequential enables the octave switchers through Decoder IC156.

UP ONLY

With the down only switch in the off position, the Golden Harp is in the up only mode of operation. Positive voltage is routed through the series switch configuration to Pin 1 of IC157B and through Diode D732 to Pin 1 of IC151C. These gates can now be enabled as the octave count advances. Q472 is cut off applying a high level to Pin 10 of IC153. When the Scan Oscillator is enabled, the Counter IC153 begins an up count. At this time, the Octave Counter is at its zero count and Pin 3 of IC156 is high. This high level is inhibited by gate IC157A and there is no output to the switchers. In this condition, the bases of Q475 and Q478 are low causing Q476 and Q479 to be saturated. With Q476 and Q479 saturated, the high octave and middle octave enable lines are grounded and Q477 will be off, enabling the low octave. On the next advance of the Octave Counter, Pin 14 of IC156 goes high and turns off Q479 through Q478. When Q479 turns off, it unclamps the middle octave enable line allowing the middle octave to play. At the same time positive voltage is applied to Q477, turning it on which clamps the low octave enable line to ground. On the next advance of the Octave Counter, Pin 2 of IC156 goes high. This high level is applied to Pin 2 of IC157B. Since Pin 1 is high due to the down only switch position, the output of IC157B Pin 3 goes high and turns off Q476 through Q475. When Q476 turns off, it unclamps the high octave enable line allowing the high octave to play. At the same time, positive voltage is applied to Q477, turning it on and clamping the low octave enable line to ground. When the octave counter again advances, Pin 15 of IC156 goes high. This high level is applied to Pin 2 of IC151C. Since Pin 1 of IC151C is high due to the down only switch position, the output of IC151C goes high applying a positive voltage through Diode D730. This resets Octave Counter IC155 and Up/Down Counter IC153 back to their zero count. This sequence will continue in this manner as long as the Scan Oscillator is enabled.

DOWN ONLY

With the down only switch on, positive voltage is routed through the series switch configuration to Pin 5 of IC157A and through Diode D733 to Pin 1 of IC151C. These gates can now be enabled as the octave count advances. The positive voltage from the switch is also applied to the base of Q472 turning it on, applying a low level to Pin 10 of IC153. Also the octave advance pulse applied to IC150D now comes from Pin 1 of IC154. When the Scan Oscillator is enabled, the Counter IC153 begins a down count. At this time Octave Counter IC155 is at its zero count and Pin 3 of IC156 is high. This high level is applied to Pin 6 of IC157A. Since Pin 5 is high due to the down only switch position, IC157A has a positive output at Pin 4. This positive voltage turns off Q476 through Q475 ungrounding the high octave enable line, allowing the high octave to play. At the same time this voltage is also applied to Q477, turning it on which clamps the low octave enable line to ground.

On the next advance of the Octave Counter, Pin 14 goes high turning off Q479 through Q478 ungrounding the middle octave allowing it to play. At the same time this voltage is also applied to Q477 turning it on which clamps the low octave enable line to ground. The Octave Counter is advanced again and Pin 2 goes high, but this voltage cannot pass to the octave switches and the low octave is enabled by the saturated condition of Q476 and Q479. After the next count, Pin 15 of IC156 goes high. This high level is applied to Pin 2 of IC151C. Since Pin 1 is high due to the position of the down only switch, the output of IC151C goes high applying a positive voltage through Diode D730. This resets Octave Counter IC155 and Up/Down Counter IC153 back to their zero count. This sequence will continue in this manner as long as the Scan Oscillator is enabled.

UP/DOWN 2

With the Up/Down 2 switch on, positive voltage is routed to Pin 13 of IC157C and also from the arm of this switch to IC151D Pin 6. These gates can now be enabled as the octave count advances. Q472 is cut off applying a high level to Pin 10 of IC153. When the Scan Oscillator is enabled, the Counter IC153 begins an up count. The up count for the first two octaves operates as described in the up only mode. On the third advancement of the Octave Counter Pin 2 goes high. This high level is applied to Pin 12 of IC157C. Since Pin 13 is high due to the on position of the Up/Down 2 switch, Pin 11 of IC157C goes high. This performs two functions: 1) Positive voltage turns off Q479 through Q478 disabling the low octave and enabling the middle octave; 2) Positive voltage is applied to the base of Q472 turning it on which applies a low level to Pin 10 of IC153. This initiates a down count and the middle octave now counts down. On the next advancement of the Counter, Pin 15 of IC156 goes high and holds the base of Q472 high.

This holds the counter in the down count mode. At this time no voltage is routed to the switchers, automatically enabling the low octave which also counts down. On the next counter advance, Pin 1 of ICl56 goes high resetting the Octave and Up/Down Counters ICl55 and ICl53 to their zero count through IC151D. This sequence continues in this manner as long as the Scan Oscillator is enabled.

UP/DOWN 3

With the Up/Down 3 switch on, positive voltage is routed to Pin 8 of IC157D. Q472 is cut off applying a high level to Pin 10 of IC153. When the Scan Oscillator is enabled the Counter ICl53 begins an up count. The up count for the first two octaves operates as described in the up only mode. On the third advancement of the Octave Counter, Pin 2 of ICl56 goes high and is routed through D734 to Pin 9 of IC157D. Pin 8 of IC157D is high due to the on condition of the Up/Down 3 switch. This causes the output Pin 10 of IC157D to go high. This high level turns off Q476 through Q475 and enables the high octave. Voltage is also applied to Q477 clamping the low octave enable line to ground. When the octave counter is advanced again, Pin 15 goes high. Positive voltage is routed through Diode D735 to Pin 9 of IC157D. This holds IC157D in the same state as the previous count and the high octave is still enabled. Positive voltage from Pin 15 is also routed to the base of Q472, turning it on. This applies a low to Pin 10 of ICl53 which initiates a down count. This causes the high octave to play again but in the down direction. On the next count, Pin 1 of ICl56 goes high which holds Q472 on, and also enables the middle octave through Q478 and Q479. This allows the middle octave to play in the down direction. When the octave counter advances again, Pin 6 of IC156 goes high holding Q472 on; the low octave is automatically enabled by Q477, since there is no output to the switchers. This enables the low octave to count down. The counter advances again and Pin 7 of IC156 goes high, resetting the octave and up/down counters to their zero count. The Up/Down 3 sequence will continue in this manner as long as the Scan Oscillator is enabled.

VIRTUOSO

In the Virtuoso mode of operation, the up/down counter will count three active notes in one direction, reverse direction for one active note, then resume in the original direction for three more active notes and so on. Turning on the Virtuoso switch turns off Virtuoso Switcher Q471. This removes the reset condition from Pulse Dividers IC147A&B, allowing them to count. IC147A&B comprise two divide-by-two dividers. The clock input of IC147A is connected to Stop Scan Trigger IC151A. The output of IC151A goes high and clocks IC147A each time an active note is found. After three active notes have been found, the Q bar outputs of IC147A&B will both be low. This causes the output of Gate ICl48A to go high. This high level is applied to the up/down enable gates and will invert the existing condition at Pin 10 of IC149D. When the next pulse from the scan oscillator is applied to Pin 15 of ICl53, the direction of the count is reversed and the note previous to the one that has just been played is played again. When the scan oscillator is stopped to play this note, another pulse is applied from IC151A to the Virtuoso Pulse Dividers. This inverts the output of IC148A which in turn inverts the output of IC149D. The output of IC149D is now in its original state and the counter will resume its original direction of count until three more active notes have been found. Also, when the output of IC149A goes high, it applies a low through Inverter IC149A to Pin 10 of Octave Counter ICl55. If, when the count is reversed, an octave must be crossed to play the previous note, a pulse will be applied to Octave Counter IC155 Pin 15. The low on Pin 10 will allow the Octave Counter (which normally counts only in the up direction) to count down and enable the correct octave line for this note.

SCHEMATIC 23

REVERB, VOLUME REGULATORS & AMPLIFIERS

Audio signal from the Flute Mixing Preamp, Main Mixing Preamp, Bass Emitter Follower, Orchestral Symphonizer and Phase 1 Output Amps is channelled two ways simultaneously: through the reverb circuitry and their respective volume regulators. The reverb output is then routed to the Main Volume Regulators.

IC161A REVERB DRIVER

Audio output signal from the Flute Mixing Preamp, Main Mixing Preamp, Bass Emitter Follower, Orchestral Symphonizer and Phase 1 Output Amps is applied to IC161A where it is amplified and connected to the Reverb Spring unit producing the reverb effect.

IC161B REVERB RECOVERY AMP

Reverberating audio signal from the Reverb Spring unit is applied to IC161B. The signal is amplified by a gain factor of approximately 33 and transformed to a low impedance signal before being routed to the Main Volume Regulator via the Reverb Length Control VR62.

CIRCUIT DESCRIPTION

Q483 VOLUME REGULATOR DRIVER

The amplitude of the signal at the output of the volume regulators is controlled by the Volume Regulator Driver Q483. Pressing the expression shoe down moves the lamp in Expression Pedal Photocell P5 closer to the photocell, decreasing the photocell's resistance, which increases the voltage on the base of Q483. This in turn increases the emitter voltage of Q483. Applying this voltage to Pin 5 of the volume regulators increases the amplitude of their output signal.

IC162, Q484 MAIN VOLUME REGULATOR & OUTPUT AMP

Audio signal from the Main Mixing Preamp, Bass Emitter Follower, Rhythm Output Amp and Reverb is applied to IC162 where the amplitude of the Main output signal is regulated. Some signal from the Bass Emitter Follower bypasses IC162 allowing some Bass signal to pass to the Main Output Amp Q484 when the organ is at minimum volume. The output of IC162 is applied to Q484 where it is amplified before being routed to the Main power amplifier.

IC163, Q485 LESLIE VOLUME REGULATOR & OUTPUT AMP

Audio signal from the Flute Mixing Preamp and the Bass Emitter Follower is applied to IC163 where the amplitude of the Leslie output signal is regulated. The output of IC163 is applied to Q485. Here the signal is amplified before being routed to the Leslie power amplifier.

IC164, IC165 PHASE 2 AND 3 VOLUME REGULATORS

Audio signal from the Phase 2 and 3 Output Amps and the Orchestral Symphonizer is applied to IC164 and IC165 where the amplitude of these signals is regulated. The outputs from the Volume Regulators is then routed to the Phase 2 and 3 Power Amplifiers.

Q485-Q491 AND IC166 MAIN, LESLIE, PHASE 2 CHORUS AND PHASE 3 CHORUS AMPS

These four amplifiers are identical. They are self-biasing with a complimentary output configuration. The power output is rated at 35 watts RMS for each amplifier. The function of the preamp is to boost the signal voltage to a point where they can be used by the driver circuit. Preamp Q487 senses the signal at the output of the amplifier and controls it by regulating the signal input at Preamp Q486. The driver inverts the audio voltages so the outputs work in push-pull. The outputs convert the voltage from the driver into high current, low voltage output signal that is connected via the speaker enable relay contacts to the speakers.

With no signal input, Bias Switcher Q489 is on and there is virtually no current being drawn by the outputs. IC166A&B have a total gain of approximately 1000. When an input signal as small as one milli-volt is applied to the amp, the bias on the base of Q489 is overcome and it shuts off, enabling the amplifier.

Q492 SPEAKER ENABLE RELAY DRIVER

At organ turn on, the DC voltage applied to the base of Q492 sees a ground through the 15 uf capacitor. As the capacitor charges, the voltage at the base of Q492 increases which eventually turns on Q492 and activates the Speaker Enable Relay. The time delay is the RC time constant determined by the 150K resistor and the 15 uf capacitor. When a headphone is used, the base of Q492 is grounded through a IK resistor which causes RL1 to de-energize.

SCHEMATIC 24

POWER SUPPLY

AC line voltage is converted into positive and negative DC supply voltages using step down Transformer Tl and Rectifier Bridge D751. Regulators IC170-IC176 are used as voltage regulators on several supply lines. IC170 has a 100 ohm DC offset resistor. The output of IC170 will measure 9.5 volts to ground reference. IC173 has a DC offset Voltage Adjust VR67. It is adjusted for 14 volts at the output of IC173. Some of the voltage divider circuits are located on various boards throughout the organ. They are enclosed in dotted boxes with a note for their location. Q495 regulates voltage for the DC control. A 5-amp slo-blo fuse is employed in the primary circuit of the power supply to prevent component damage which may be caused by a short circuit.

ADJUSTMENTS

SCHEMATIC 1

VR1 VIBRATO SPEED ADJUSTMENT
Proper speed of the Vibrato Oscillator is between 6 and 7 Hz. The Vibrato Oscillator will not oscillate if adjustment is extreme.

LI TUNING COIL
This adjustment is carefully set at the factory. Should tuning be necessary, it is suggested a tuning fork for a certain note be used (C for example). By holding down a key (C for example), adjust the tuning coil with a non-metalic screwdriver until no roll or beat is heard between the organ note and fork tone. When this note is properly tuned, the TOS tuning is automatically locked in.

SCHEMATIC 2

VR4 SYMPHONIC WOW ADJUSTMENT
This adjustment should be set for 1.2 volts at the cathode of D56. Too extreme an adjustment will result in the loss of the Symphonic Wow effect.

SCHEMATIC 7

VR15 GENIE THUMP ADJUSTMENT
The Genie length is factory-set by component values. The purpose of the Genie Thump Adjustment is to eliminate any DC transient (thump) that may occur when playing the Genie Accompaniment voices. To adjust, turn on any rhythm and a Genie accompaniment tabswitch (Piano, Guitar, Banjo) set rhythm volume at minimum and expression shoe at maximum. Turn adjustment until minimum thump is heard. If thump level cannot be reduced satisfactorily by adjustment, then replace Genie Modulator IC.

SCHEMATIC 8

VR19 PERCUSSION THUMP ADJUSTMENT
The Percussion length is factory-set by component values. The purpose of the Percussion Thump Adjustment is to eliminate any DC transient (thump) that may occur when playing the Banjo, Harmonic Flute or Mandolin voices. To adjust, set expression shoe on maximum. Turn on either the Mandolin, Harmonic Flute or Banjo tabs. Turn adjustment until minimum thump is heard. If thump cannot be reduced satisfactorily by adjustment, then replace Modulator IC.

SCHEMATIC 10

VR22 PEDAL WOW REST ADJUSTMENT
This adjustment should be set for 1.2 volts at Pin 14 of IC20C. Too extreme an adjustment will result in the loss of the Pedal Wow effect.

SCHEMATIC 12

VR27 CLOCK 1 SPEED ADJUSTMENT
This adjustment is set at the factory for 19 Hz. Readjustment should only be necessary when circuit components are replaced. Extreme adjustment will result in the loss of chorus effect.

VR26 CLOCK 2 SPEED ADJUSTMENT
This adjustment is set at the factory for 2.2 Hz. Readjustment should only be necessary when circuit components are replaced. Extreme adjustment will result in the loss of chorus effect.

VR28, VR29 AND VR30 PHASE 1, 2 AND 3 LEVEL ADJUSTMENT
These adjustments affect the volume of the Phase 1, 2 and 3 outputs. The output volume of each phase should be equal. The combined output of the three phases should equal the Flute volume with the chorus switch off.

SCHEMATIC 13

VR33 AOC RANGE ADJUSTMENT
This adjustment regulates the voltage supply to the AOC keyers, thereby adjusting the AOC range. Too extreme an adjustment will cause dissonant chords when playing AOC.

SCHEMATIC 14

L13 CHORD TUNING COIL
First, tune LI as described above. Then turn off the Magic Chord tab and all Rhythm tabs. Turn on only the Lower Keyboard String Bass voice and Upper Keyboard Kinura voice. Now, holding a C on both the Upper and Lower Keyboards, adjust Tuning Coil L13 until no roll or beat is heard between the two notes.
NOTE: When tuning, always make sure all vibrato and vibrato pre-set voices are off.

VR40 CHORD LEVEL ADJUSTMENT
With the Magic Chord tab off, hold a three-note left-hand chord; switch the Magic Chord tab on and hold the same chord, but as a Genie one-note chord. Adjust VR40 until the volume level of the chord is the same with the Magic Chord tab on or off.

ADJUSTMENTS

SCHEMATIC 20

VR54 CHORUS SPEED OSCILLATOR ADJUSTMENT

This adjustment regulates the frequency of the Chorus Speed Oscillator. The factory setting is .7 Hz; too extreme an adjustment will result in the loss of chorus effect on the Orchestral Symphonizer presets.

VR53 BIAS ADJUSTMENT

This adjustment adjusts the bias voltage for the Bucket Brigade IC140. With the French Horn preset on and a chord held, turn VR53 in both directions until distortion occurs. Proper setting is the midpoint between the distortion regions.

SCHEMATIC 23

VR64 MINIMUM ORGAN ADJUSTMENT

Set this adjustment by turning only the Flute 8 tab on. Hold down a key with the expression shoe at minimum expression and turn VR64 until the note being held can just be heard.

VR63 MAXIMUM ORGAN ADJUSTMENT

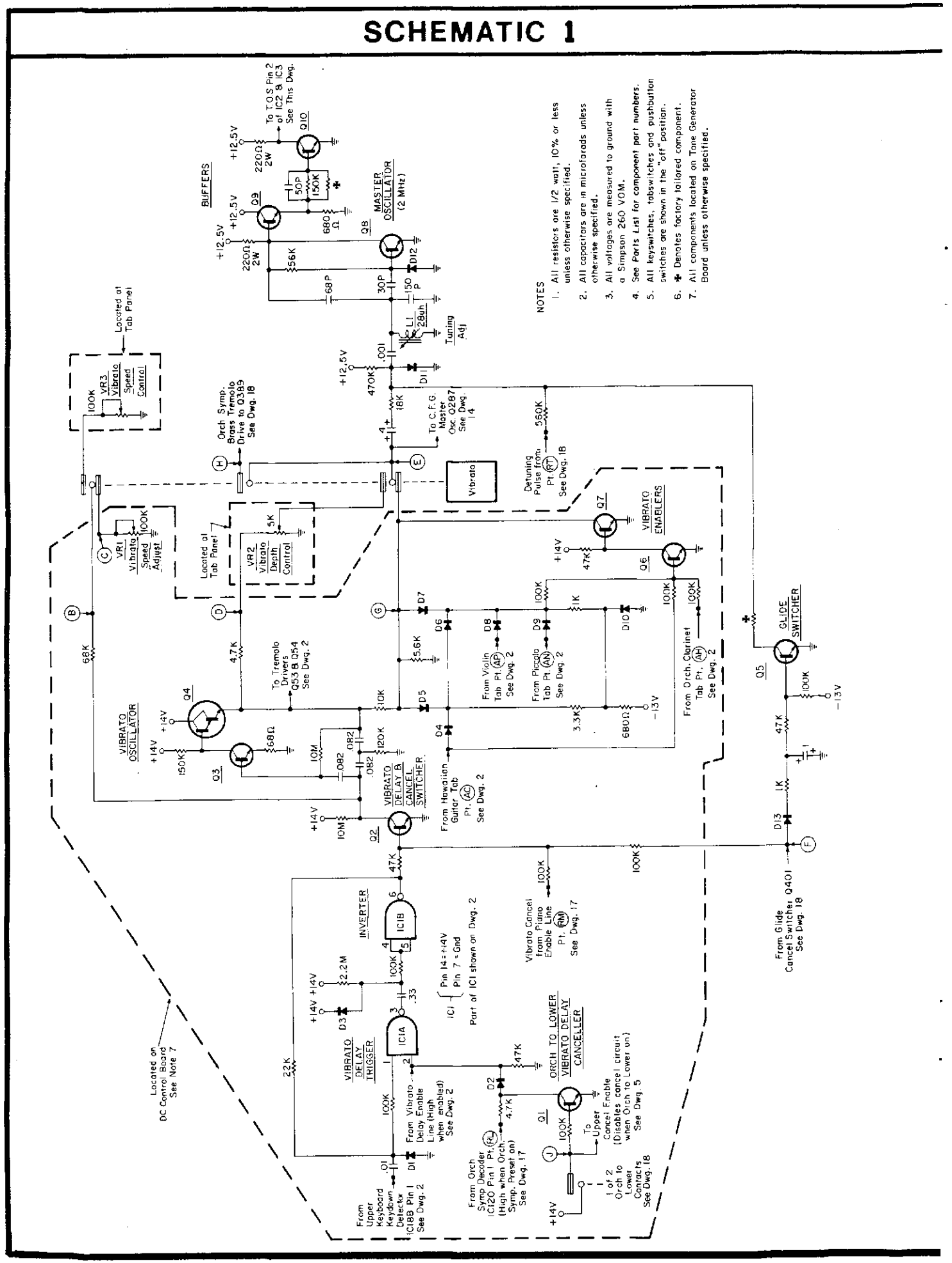
This adjustment is factory-set for maximum output at full expression shoe. Adjustment of VR63 effects only the maximum volume level of the organ and does not effect the minimum adjustment setting.

SCHEMATIC 24

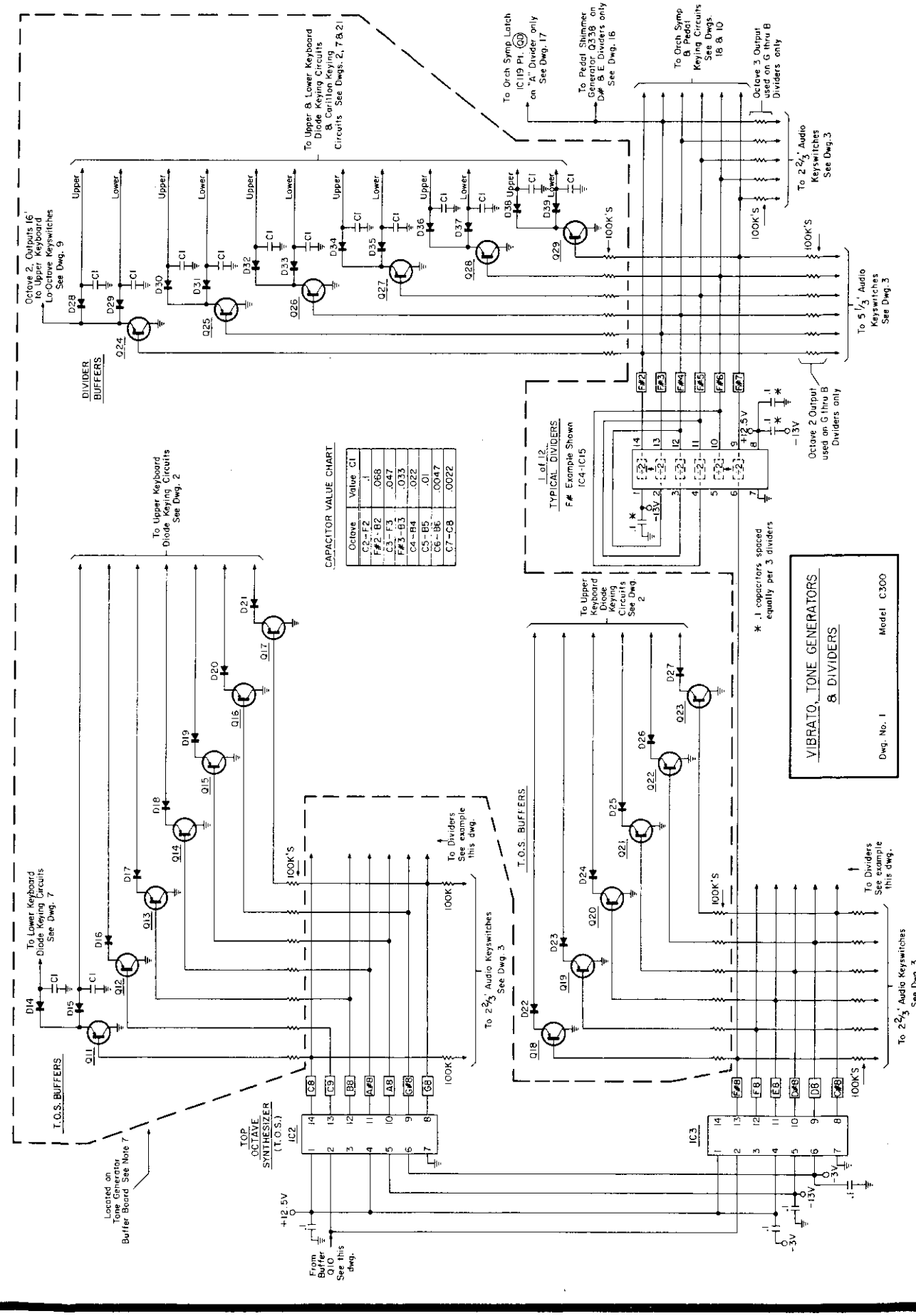
VR67 VOLTAGE ADJUSTMENT

VR67 adjusts the DC voltage outputted from IC173 and should be set for 14 volts at IC173 Pin 2.

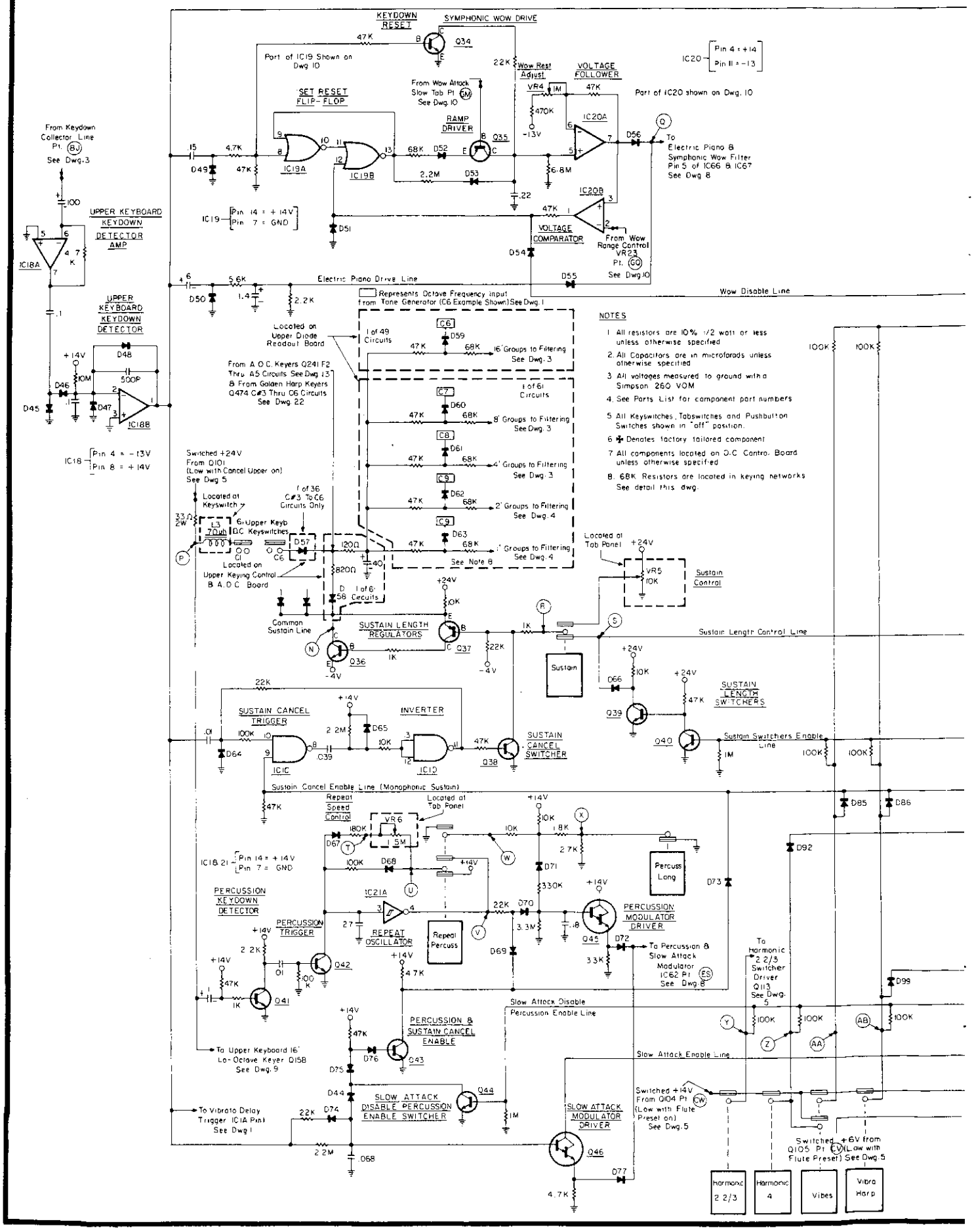
SCHEMATIC 1


NOTES
1. All resistors are 1/2 watt, 10% or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages are measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches are shown in the "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Tone Generator Board unless otherwise specified.
BUFFERS
MASTER OSCILLATOR (2 MHz)
Tuning Adj
To T.O.S. Pin 2 of IC2 & IC3 See This Dwg.
To C.F.G. Master Osc. Q287 See Dwg. 14
Orch Symp. Brass Tremolo Drive to Q385 See Dwg. 18
Located at Tab Panel
VR3 Vibrato Speed Control
VR1 Vibrato Speed Adjust
VR2 Vibrato Depth Control
Vibrato
Detuning Pulse from Pt. (ET) See Dwg. 18
VIBRATO ENABLERS
GLIDE SWITCHER
To Tremolo Inverter Q53 & Q54 See Dwg. 2
From Violin Tab Pt. (AF) See Dwg. 2
From Piccolo Tab Pt. (AH) See Dwg. 2
From Orch. Clarinet Tab Pt. (AH) See Dwg. 2
From Hawaiian Guitar Tab Pt. (AC) See Dwg. 2
VIBRATO OSCILLATOR
VIBRATO DELAY & CANCEL SWITCHER
INVERTER
VIBRATO DELAY TRIGGER
From Vibrato Delay Enable Line (High when enabled) See Dwg. 2
Pin 14 = +14V
Pin 7 = Gnd
IC1 Part of IC1 shown on Dwg. 2
Vibrato Cancel From Piano Enable Line Pt. (FM) See Dwg. 17
ORCH TO LOWER VIBRATO DELAY CANCELLER
From Orch Symp Decoder IC120 Pin 1 Pt. (FL) (High when Orch Symp. Preset on) See Dwg. 17
To Upper Cancel Enable (Disables cancel circuit when Orch is Lower only)
1 of 2 Orch to Lower Control See Dwg. 5
From Upper Keyboard Keydown Detector IC18B Pin 1 See Dwg. 2
From Glide Cancel Switcher Q401 See Dwg. 18
Located on DC Control Board See Note 7

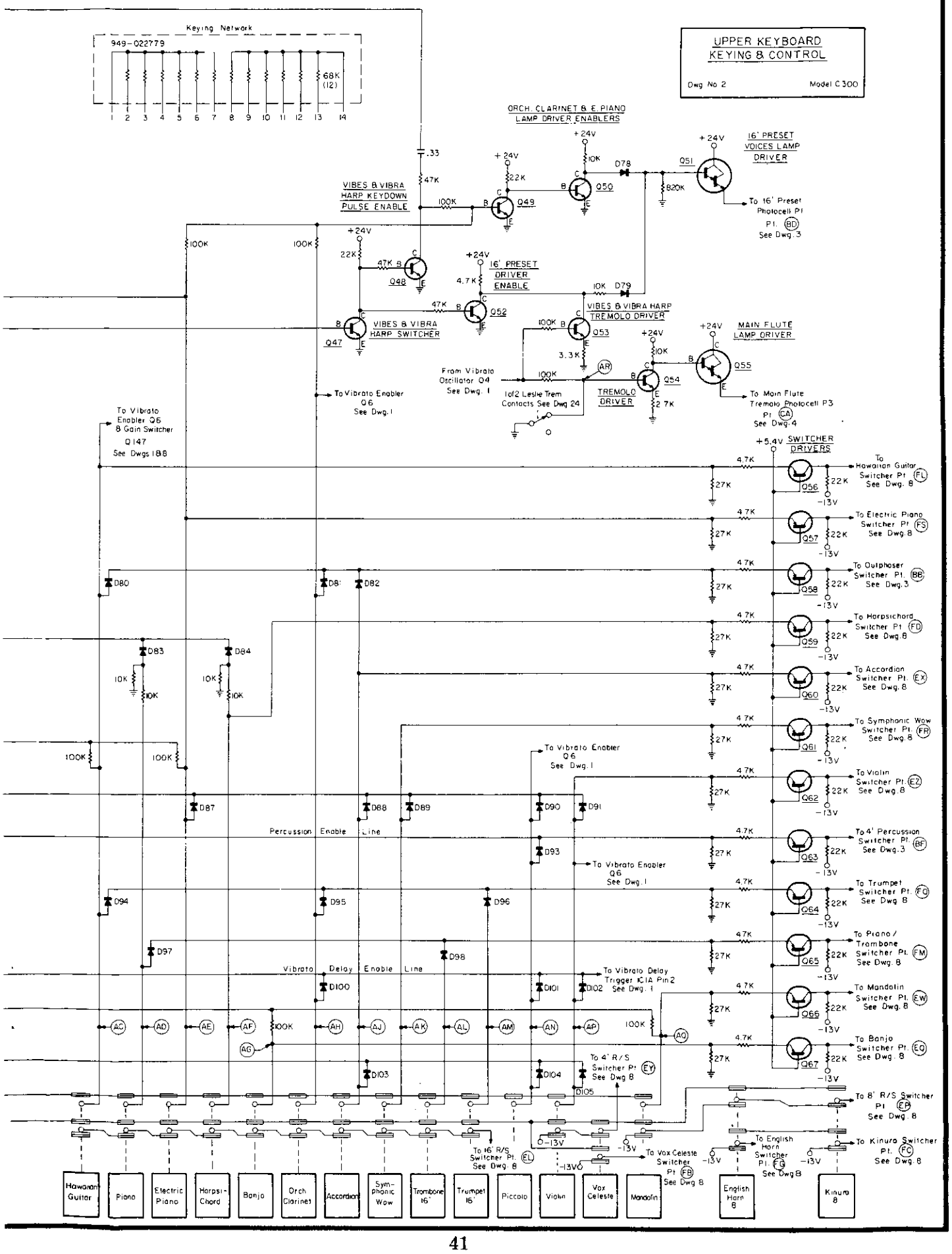
SCHEMATIC 1


VIBRATO, TONE GENERATORS & DIVIDERS
Dwg. No. 1
Model C300
DIVIDER BUFFERS
T.O.S. BUFFERS
TOP OCTAVE SYNTHESIZER (T.O.S.) IC2
1 of 12 TYPICAL DIVIDERS F# Example Shown IC4-IC15
CAPACITOR VALUE CHART
Octave | Value C1
C2-F2 | .1
F#2-B2 | .068
C3-F3 | .047
F#3-B3 | .033
C4-B4 | .022
C5-B5 | .01
C6-B6 | .0047
C7-C8 | .0022
* .1 capacitors spaced equally per 3 dividers
To Upper & Lower Keyboard Diode Keying Circuits & Carillon Keying Circuits See Dwgs. 2, 7 & 21
To Orch Symp Latch IC19 Pt. (C) on "A" Divider only See Dwg. 17
To Pedal Shimmer Generator Q33 on Divider Board "E" See Dwg. 16
To Orch Symp Buffer Diode Keying Circuits See Dwgs. 18 & 10
Octave 3 Output used on G thru B Dividers only
To 2 2/3' Audio Keyswitches See Dwg. 3
To 5 1/3' Audio Keyswitches See Dwg. 3
Octave 2 Output used on G thru B Dividers only
Octave 2, Outputs 16' to Upper Keyboard or Octave Keyswitches See Dwg. 9
To Upper Keyboard Diode Keying Circuits See Dwg. 2
To Lower Keyboard Diode Keying Circuits See Dwg. 7
To Upper Keyboard Diode Keying Circuits See Dwg 2
To Dividers See example this dwg.
To 2 2/3' Audio Keyswitches See Dwg. 3
Located on Tone Generator Buffer Board See Note 7
From Buffer D10 See this dwg.
+12.5V
-13V
-3V
100K'S

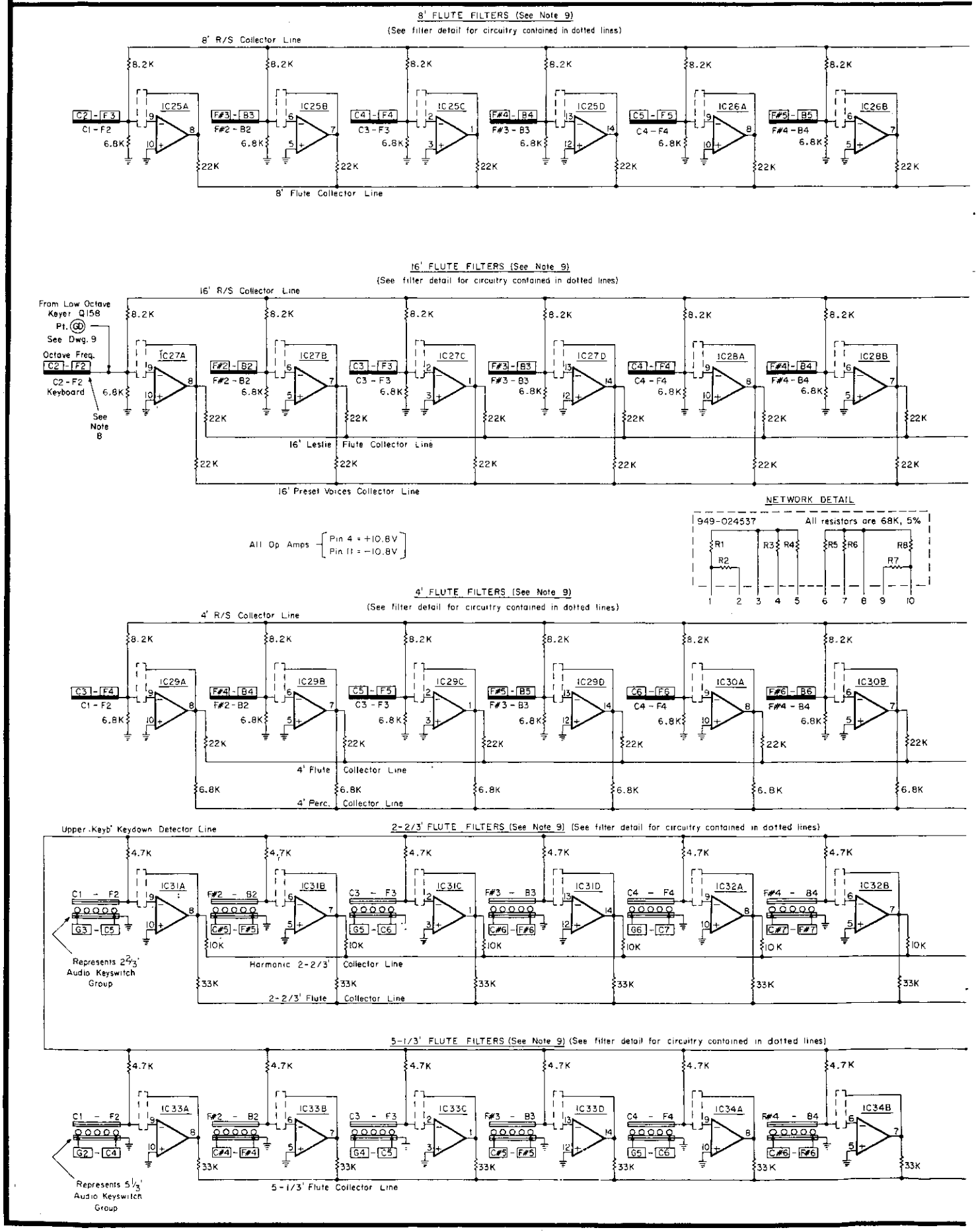
SCHEMATIC 2


KEYDOWN RESET
SYMPHONIC WOW DRIVE
Q34
Part of IC19 Shown on Dwg 10
22K Wow Rest Adjust
VOLTAGE FOLLOWER
IC20 Pin 4 = +14 Pin 11 = -13
From Wow Attack Slow Tab Pt (M) See Dwg. 10
SET RESET FLIP-FLOP
VR4 1M
47K
Part of IC20 shown on Dwg. 10
470K
RAMP DRIVER
-13V
IC20A
Q35
D56
To Electric Piano & Symphonic Wow Filter Pin 5 of IC66 & IC67 See Dwg 8
From Keydown Collector Line Pt. (BJ) See Dwg.3
.15
4.7K
D49
47K
IC19A
IC19B
68K
D52
2.2M
D53
6.8M
.22
IC20B
100
IC19 Pin 14 = +14V Pin 7 = GND
UPPER KEYBOARD KEYDOWN DETECTOR AMP
IC18A
VOLTAGE COMPARATOR
From Wow Range Control VR23 Pt. (GO) See Dwg.10
D51
D54
D55
Electric Piano Drive Line
Wow Disable Line
5.6K
D50
1.4
2.2K
Represents Octave Frequency Input from Tone Generator (C6 Example Shown) See Dwg. 1
UPPER KEYBOARD KEYDOWN DETECTOR
.1
+14V
D48
500P
10M
D46
D47
IC18B
D45
IC18 Pin 4 = -13V Pin 8 = +14V
Located on Upper Diode Readout Board
1 of 49 Circuits
C6
D59
47K
68K
16' Groups to Filtering See Dwg. 3
From A.O.C. Keyers Q241 F2 Thru A5 Circuits See Dwg. 13 & From Golden Harp Keyers Q474 C#3 Thru C6 Circuits See Dwg. 22
1 of 61 Circuits
C7
D60
8' Groups to Filtering See Dwg. 3
C8
D61
4' Groups to Filtering See Dwg. 3
C9
D62
2' Groups to Filtering See Dwg. 4
C9
D63
1' Groups to Filtering See Dwg. 4
See Note 8
NOTES
1. All resistors are 10% 1/2 watt or less unless otherwise specified
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✣ Denotes factory tailored component
7. All components located on D.C. Control Board unless otherwise specified
8. 68K Resistors are located in keying networks See detail this dwg.
100K
Switched +24V From Q101 (Low with Cancel Upper on) See Dwg 5
Located at Keyswitch
33Ω 2W
L3 .70uh
6' Upper Keyb D.C. Keyswitches
C1
C6
Located on Upper Keying Control B.A.D.C. Board
D57
120Ω
.40
820Ω
1 of 36 C#3 To C6 Circuits Only
D 1 of 6 Circuits
D58
Common Sustain Line
Located at Tab Panel
+24V
VR5 10K
Sustain Control
SUSTAIN LENGTH REGULATORS
Q36
Q37
22K
1K
Sustain Length Control Line
Sustain
SUSTAIN CANCEL TRIGGER
INVERTER
SUSTAIN CANCEL SWITCHER
IC1C
IC1D
.039
.01
D64
2.2M
D65
Q38
SUSTAIN LENGTH SWITCHERS
D66
Q39
Q40
Sustain Swithchers Enable Line
Sustain Cancel Enable Line (Monophonic Sustain)
D85
D86
Repeat Speed Control
VR6 1.5M
180K
D67
D68
IC18 Pin 14 = +14V Pin 7 = GND
IC21A
PERCUSSION KEYDOWN DETECTOR
PERCUSSION TRIGGER
REPEAT OSCILLATOR
Repeat Percuss
D71
330K
2.7K
1.8K
Percuss Long
D73
D92
PERCUSSION MODULATOR DRIVER
Q45
D72
3.3K
To Percussion & Slow Attack Modulator IC62 Pt (ES) See Dwg. 8
To Harmonic 2 2/3 Switcher Driver Q113 See Dwg. 5
D99
Slow Attack Disable
Percussion Enable Line
PERCUSSION & SUSTAIN CANCEL ENABLE
Q43
D76
D75
D44
Slow Attack Enable Line
To Upper Keyboard 16' Lo-Octave Keyer Q158 See Dwg. 9
To Vibrato Delay Trigger (C1A Pin) See Dwg 1
SLOW ATTACK DISABLE PERCUSSION ENABLE SWITCHER
Q44
22K
D74
2.2M
.068
SLOW ATTACK MODULATOR DRIVER
Q46
D77
4.7K
Switched +14V From Q104 Pt (CW) (Low with Flute Preset on) See Dwg. 5
Switched +6V from Q105 Pt (CV) (Low with Flute Preset) See Dwg. 5
Harmonic 2 2/3
Harmonic 4
Vibes
Vibra Harp

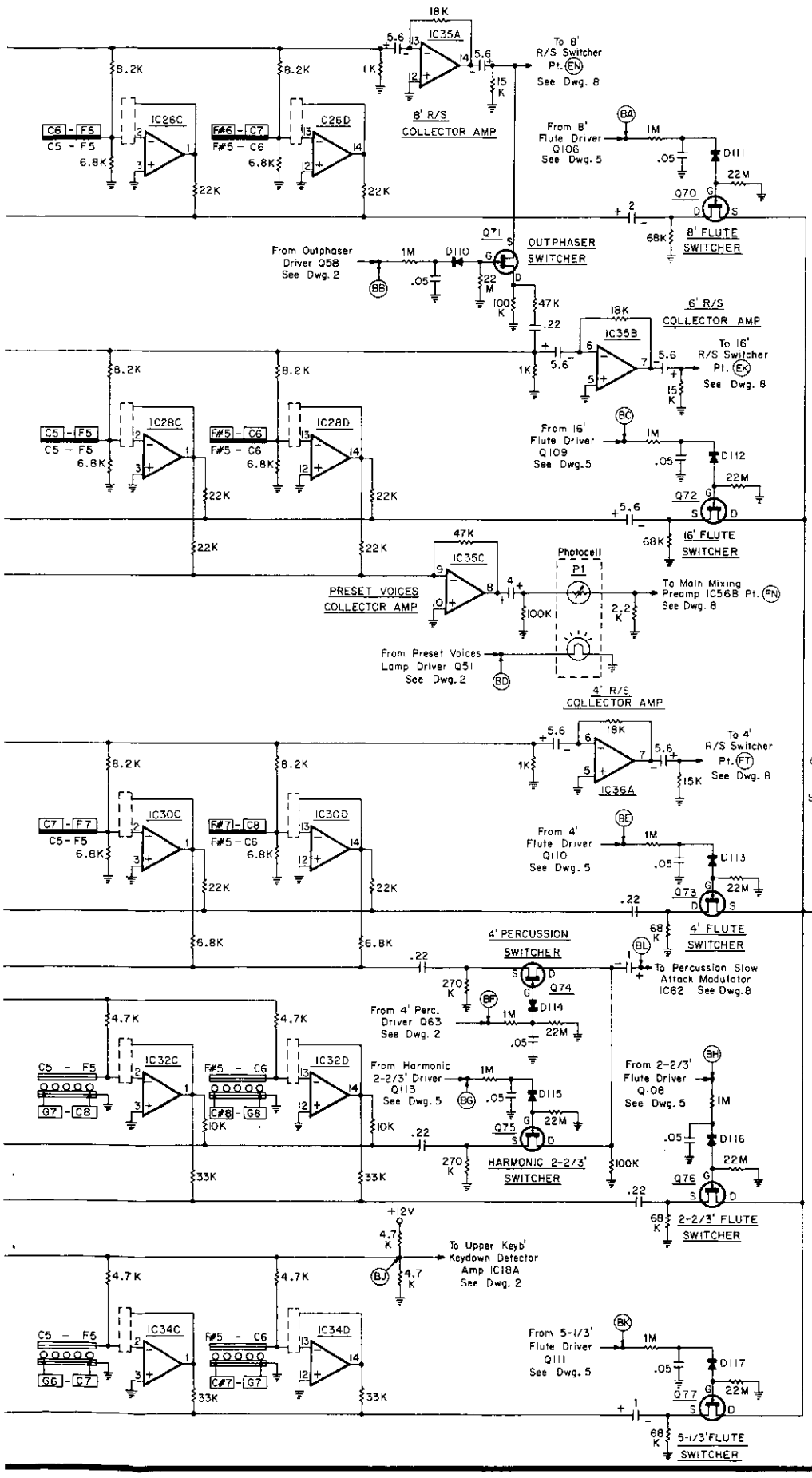
SCHEMATIC 2


UPPER KEYBOARD
KEYING & CONTROL
Dwg No. 2
Model C-300
Keying Network
949-022779
68K (12)
1 2 3 4 5 6 7 8 9 10 11 12 13 14
ORCH. CLARINET & E. PIANO LAMP DRIVER ENABLERS
VIBES & VIBRA HARP KEYDOWN PULSE ENABLE
16' PRESET VOICES LAMP DRIVER
To 16' Preset Photocell P1 P1. (BD) See Dwg. 3
16' PRESET DRIVER ENABLE
VIBES & VIBRA HARP SWITCHER
VIBES & VIBRA HARP TREMOLO DRIVER
MAIN FLUTE LAMP DRIVER
From Vibrato Oscillator Q4 See Dwg. 1
1of2 Leslie Trem Contacts See Dwg 24
TREMOLO DRIVER
To Vibrato Enabler Q6 See Dwg. 1
To Main Flute Tremolo Photocell P3 Pt. (CA) See Dwg. 4
To Vibrato Enabler Q6 & Gain Switcher Q147 See Dwgs 1&8
+5.4V SWITCHER DRIVERS
To Hawaiian Guitar Switcher Pt (FL) See Dwg. 8
To Electric Piano Switcher Pt (FS) See Dwg. 8
To Outphaser Switcher Pt. (BB) See Dwg. 3
To Harpsichord Switcher Pt. (FD) See Dwg. 8
To Accordion Switcher Pt. (EX) See Dwg. 8
To Symphonic Wow Switcher Pt. (FR) See Dwg. 8
To Violin Switcher Pt. (E2) See Dwg. 8
To 4' Percussion Switcher Pt. (BF) See Dwg. 3
To Trumpet Switcher Pt. (FC) See Dwg. 8
To Piano / Trombone Switcher Pt. (FM) See Dwg. 8
To Mandolin Switcher Pt. (EW) See Dwg. 8
To Banjo Switcher Pt. (EQ) See Dwg. 8
To 8' R/S Switcher Pt (EP) See Dwg. 8
To English Horn Switcher Pt. (FG) See Dwg. 8
To Kinura Switcher Pt. (FC) See Dwg. 8
To 16' R/S Switcher Pt. See Dwg. 8 (EL)
To Vox Celeste Switcher Pt (FB) See Dwg. 8
To 4' R/S Switcher Pt See Dwg. 8 (EY)
To Vibrato Delay Trigger K1A Pin 2 See Dwg. 1
Percussion Enable Line
Vibrato Delay Enable Line
Hawaiian Guitar
Piano
Electric Piano
Harpsi-Chord
Banjo
Orch Clarinet
Accordion
Sym-phonic Wow
Trombone 16'
Trumpet 16'
Piccolo
Violin
Vox Celeste
Mandolin
English Horn 8
Kinura 8

SCHEMATIC 3


8' FLUTE FILTERS (See Note 9)
(See filter detail for circuitry contained in dotted lines)
8' R/S Collector Line
8.2K
IC25A
IC25B
IC25C
IC25D
IC26A
IC26B
C2 - F3
C1 - F2
F#3 - B3
F#2 - B2
C4 - F4
C3 - F3
F#4 - B4
F#3 - B3
C5 - F5
C4 - F4
F#5 - B5
F#4 - B4
6.8K
22K
8' Flute Collector Line
16' FLUTE FILTERS (See Note 9)
(See filter detail for circuitry contained in dotted lines)
16' R/S Collector Line
From Low Octave Keyer Q158 Pt. (60) See Dwg. 9
Octave Freq. C2 - F2
C2 - F2 Keyboard
See Note 8
IC27A
IC27B
IC27C
IC27D
IC28A
IC28B
F#2 - B2
C3 - F3
F#3 - B3
C4 - F4
F#4 - B4
16' Leslie Flute Collector Line
16' Preset Voices Collector Line
All Op Amps — Pin 4 = +10.8V, Pin 11 = −10.8V
NETWORK DETAIL
949-024537
All resistors are 68K, 5%
R1
R2
R3
R4
R5
R6
R7
R8
1 2 3 4 5 6 7 8 9 10
4' FLUTE FILTERS (See Note 9)
(See filter detail for circuitry contained in dotted lines)
4' R/S Collector Line
IC29A
IC29B
IC29C
IC29D
IC30A
IC30B
C3 - F4
C1 - F2
F#4 - B4
F#2 - B2
C5 - F5
C3 - F3
F#5 - B5
F#3 - B3
C6 - F6
C4 - F4
F#6 - B6
F#4 - B4
4' Flute Collector Line
4' Perc. Collector Line
Upper Keyb' Keydown Detector Line
2-2/3' FLUTE FILTERS (See Note 9) (See filter detail for circuitry contained in dotted lines)
4.7K
IC31A
IC31B
IC31C
IC31D
IC32A
IC32B
C1 - F2
F#2 - B2
C3 - F3
F#3 - B3
C4 - F4
F#4 - B4
G3 - C5
C#5 - F#5
G5 - C6
C#6 - F#6
G6 - C7
C#7 - F#7
10K
33K
Represents 2 2/3' Audio Keyswitch Group
Harmonic 2-2/3' Collector Line
2-2/3' Flute Collector Line
5-1/3' FLUTE FILTERS (See Note 9) (See filter detail for circuitry contained in dotted lines)
IC33A
IC33B
IC33C
IC33D
IC34A
IC34B
G2 - C4
C#4 - F#4
G4 - C5
C#5 - F#5
G5 - C6
C#6 - F#6
Represents 5 1/3' Audio Keyswitch Group
5-1/3' Flute Collector Line

SCHEMATIC 3

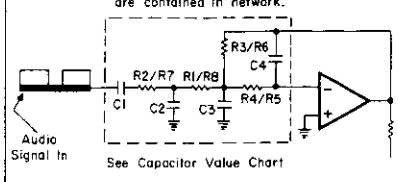


C2, C3 & C4 are 5% tolerance

Capacitor Value Chart					
	Group Octave Freq. Range	C1	C2	C3	C4
4', 8' & 16' Groups	C2-F2	.22	.1	.15	.0047
	F#2-B2	.12	.075	.1	.0033
	C3-F3	.068	.05	.075	.0022
	F#3-B3	.047	.039	.056	.0015
	C4-F4	.039	.027	.039	.001
	F#4-B4	.015	.02	.027	750P
	C5-F5	.01	.014	.02	560P
	F#5-C6	.0082	.01	.014	390P
	C2-F3	.068	.05	.075	.0022
	F#5-B5	.0082	.01	.014	390P
	C6-F6	.0068	.0068	.01	270P
	F#6-C7	.0047	.0047	.0068	200P
	C3-F4	.039	.027	.039	.001
	F#6-B6	.0047	.0047	.0068	200P
	C7-F7	.0033	.0033	.0047	130P
	F#7-C8	.0022	.0024	.0033	82P
2-2/3' & 5-1/3' Groups	G2-C4	.047	.039	.056	.0015
	C#4-F#4	.02	.027	.039	.001
	G4-C5	.02	.02	.027	750P
	C#5-F#5	.01	.014	.02	560P
	G5-C6	.01	.01	.014	390P
	C#6-F#6	.0068	.0068	.01	270P
	G6-C7	.0068	.0047	.0068	200P
	C#7-G7	.0047	.0033	.0047	130P
	G3-C5	.039	.02	.027	750P
	C#7-F#7	.0047	.0033	.0047	130P
	G7-C8	.0047	.0024	.0033	82P
	C#8-G8	.0039	.0016	.0024	68P

FILTER DETAIL

All resistors with "R" No's are contained in network.



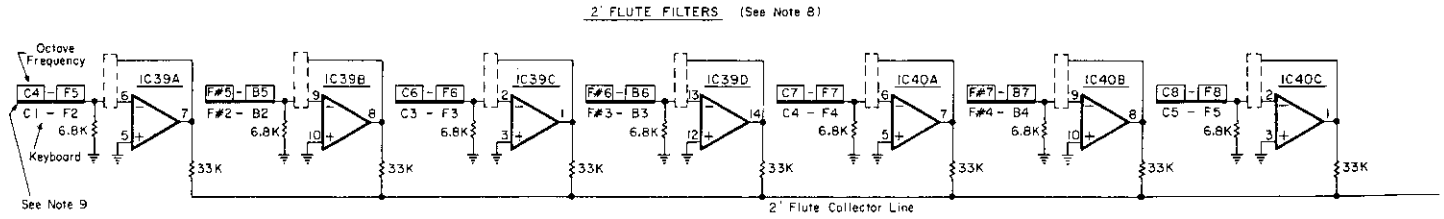
NOTES

1. All resistors are ±10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Upper Flute Symp. String Filter Board unless otherwise specified.
8. Bold lines indicate Diode Keying Groups, one note example shown on Dwg. 2.
9. See Filter Detail for circuitry contained in dotted lines.

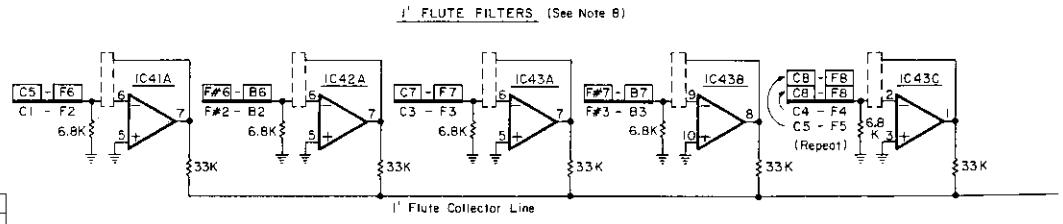
UPPER KEYBOARD 2-2/3', 4', 5-1/3', 8' & 16' FLUTE FILTERS & SWITCHING

Dwg. No. 3 Model C300

SCHEMATIC 4



All Op Amps — Pin 4 = +10.8V, Pin 11 = −10.8V

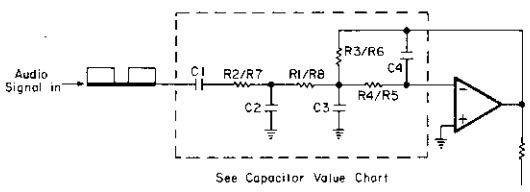


Capacitor Value Chart					
	Group Octave Freq. Range	C1	C2	C3	C4
Upper Keyboard 1 & 2 Groups	C4-F5	.01	.014	.02	560P
	F#5-B5	.0082	.01	.014	390P
	C6-F6	.0068	.0068	.01	270P
	F#6-B6	.0047	.0047	.0068	200P
	C7-F7	.0033	.0033	.0047	130P
	F#7-B7	.0022	.0024	.0033	82P
	C8-F8	.0018	.0016	.0024	68P
	F#8-C9	.0018	.0012	.0016	47P
Lower Keyboard 4' & 8' Groups	C5-F6	.0068	.0068	.01	270P
	C2-F3	.047	.039	.056	.0015
	F#3-B3	.039	.033	.039	.0012
	C4-F4	.015	.02	.027	750P
	F#4-B4	.01	.014	.02	560P
	C5-F5	.0082	.01	.014	390P
	F#5-B5	.0068	.0068	.01	270P
	C6-C7	.0047	.0047	.0068	200P
	C3-F4	.015	.025	.027	750P
	C6-F6	.0047	.0047	.0068	200P
	F#6-B6	.0033	.0033	.0047	130P
	C7-C8	.0022	.0024	.0033	82P

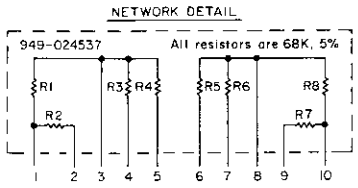
C2, C3 & C4 are 5% tolerance

FILTER DETAIL

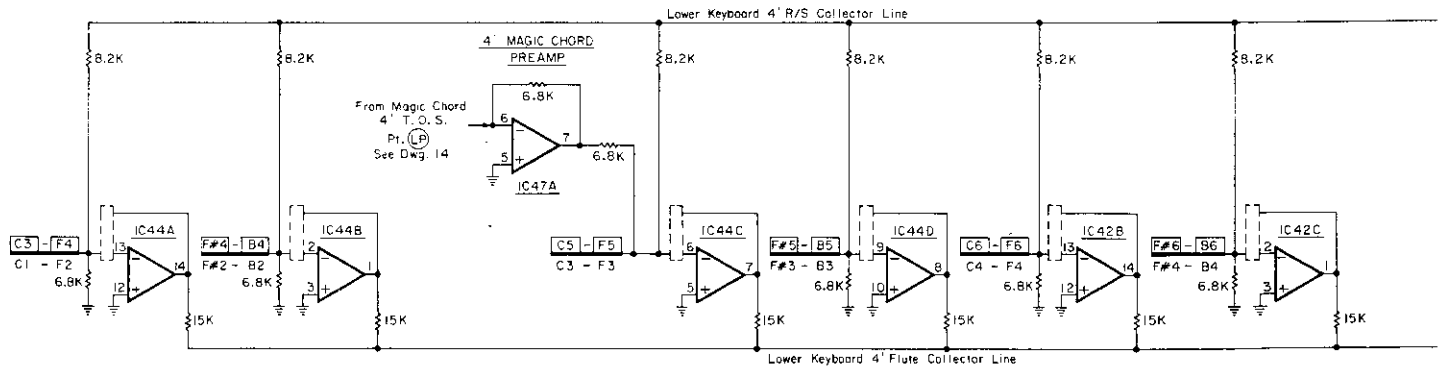
All resistors with "R" nos. are contained in network.



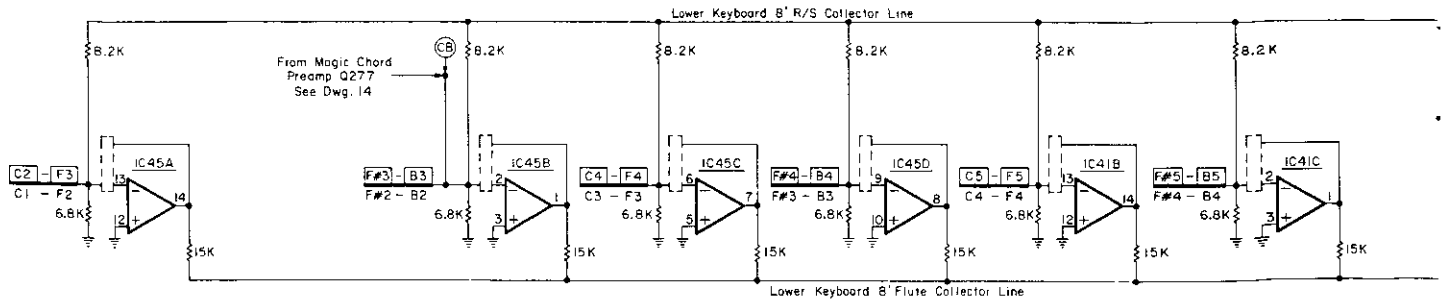
NETWORK DETAIL



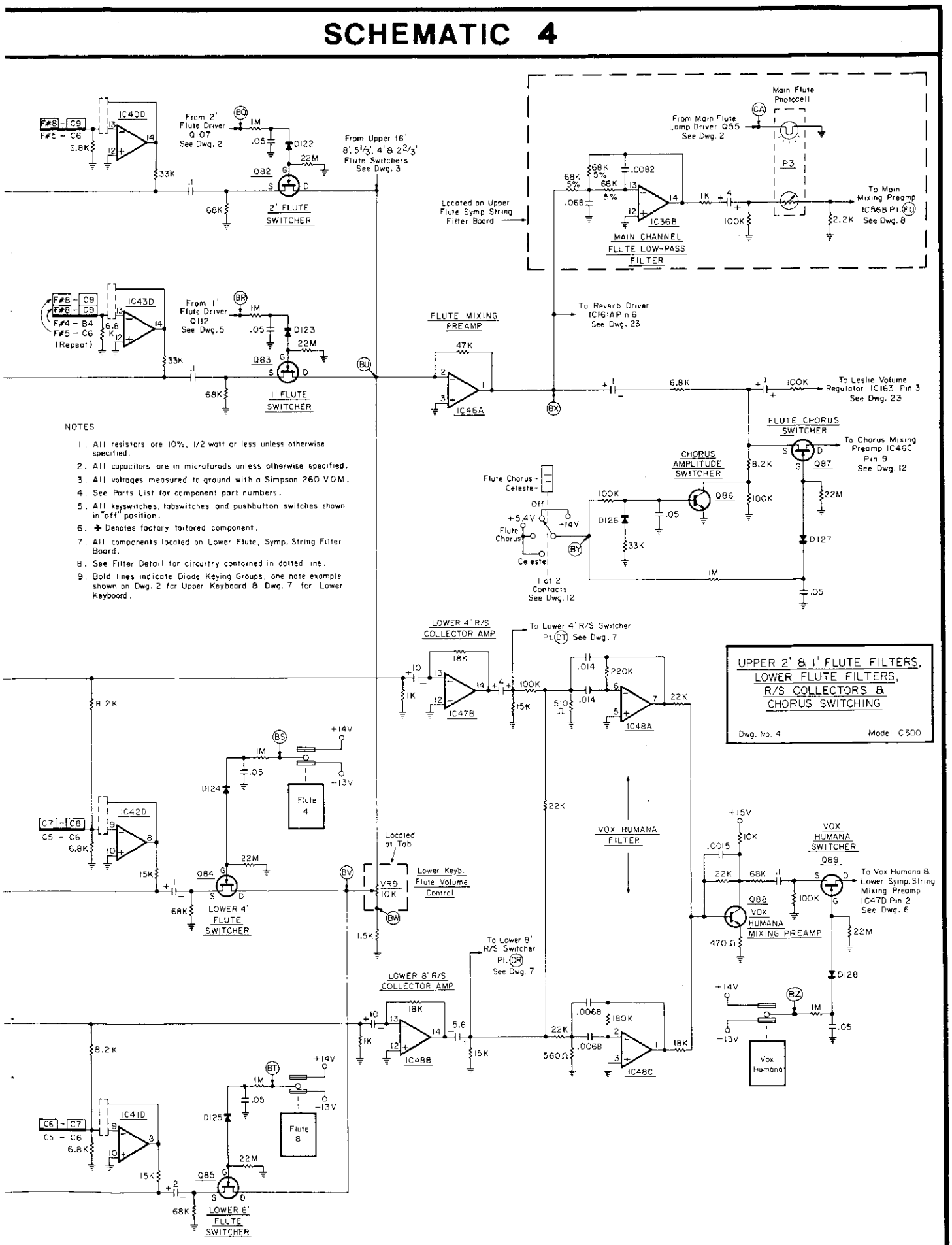
LOWER KEYBOARD 4' FLUTE FILTERS (See Note 8)



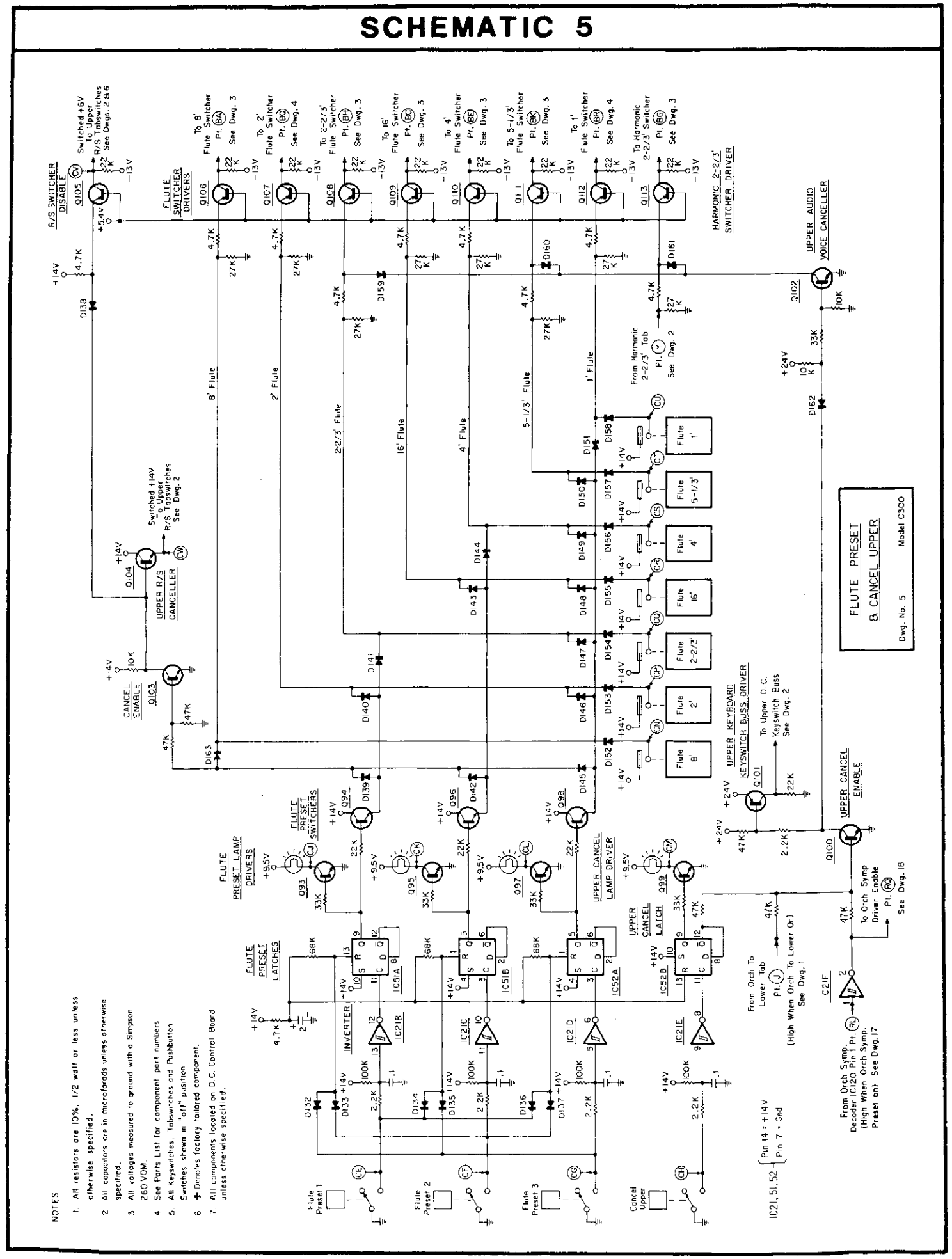
LOWER KEYBOARD 8' FLUTE FILTERS (See Note 8)



SCHEMATIC 4


F#8 - C9
F#5 - C6
IC40D
6.8K
33K
.1
68K
2' FLUTE SWITCHER
From 2' Flute Driver Q107 See Dwg. 2
1M
.05
D122
22M
Q82
From Upper 16' 8', 5 1/3', 4' & 2 2/3' Flute Switchers See Dwg. 3
F#8 - C9
F#8 - C9
F#4 - B4
F#5 - C6
(Repeat)
IC43D
6.8K
33K
68K
1' FLUTE SWITCHER
From 1' Flute Driver Q112 See Dwg. 5
D123
Q83
NOTES
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✣ Denotes factory tailored component.
7. All components located on Lower Flute, Symp. String Filter Board.
8. See Filter Detail for circuitry contained in dotted line.
9. Bold lines indicate Diode Keying Groups, one note example shown on Dwg. 2 for Upper Keyboard & Dwg. 7 for Lower Keyboard.
Located on Upper Flute Symp String Filter Board
Main Flute Photocell
From Main Flute Lamp Driver Q55 See Dwg. 2
P3
68K 5%
68K 5%
.0082
.068
68K 5%
IC36B
MAIN CHANNEL FLUTE LOW-PASS FILTER
1K
4
100K
2.2K
To Main Mixing Preamp IC56B Pt. See Dwg. 8
To Reverb Driver IC161A Pin 6 See Dwg. 23
FLUTE MIXING PREAMP
47K
IC46A
6.8K
100K
To Leslie Volume Regulator IC163 Pin 3 See Dwg. 23
FLUTE CHORUS SWITCHER
To Chorus Mixing Preamp IC46C Pin 9 See Dwg. 12
Q87
8.2K
CHORUS AMPLITUDE SWITCHER
Q86
100K
100K
22M
Flute Chorus - Celeste
Off
+5.4V
Flute Chorus
Celeste
-14V
D126
.05
33K
D127
1M
.05
1 of 2 Contacts See Dwg. 12
LOWER 4' R/S COLLECTOR AMP
To Lower 4' R/S Switcher Pt. See Dwg. 7
18K
10
1K
IC47B
4
100K
15K
.014
.014
5.10Ω
220K
IC48A
22K
UPPER 2' & 1' FLUTE FILTERS, LOWER FLUTE FILTERS, R/S COLLECTORS & CHORUS SWITCHING
Dwg. No. 4
Model C300
8.2K
+14V
1M
.05
D124
-13V
Flute 4
C7 - C8
C5 - C6
6.8K
IC42D
22M
15K
Q84
68K
LOWER 4' FLUTE SWITCHER
Located at Tab
VR9 10K
Lower Keyb. Flute Volume Control
1.5K
22K
VOX HUMANA FILTER
+15V
10K
.0015
22K
68K
.1
100K
VOX HUMANA SWITCHER
Q89
To Vox Humana & Lower Symp. String Mixing Preamp IC47D Pin 2 See Dwg. 6
Q88
VOX HUMANA MIXING PREAMP
470Ω
22M
D128
+14V
1M
.05
-13V
Vox Humana
To Lower 8' R/S Switcher Pt. See Dwg. 7
LOWER 8' R/S COLLECTOR AMP
18K
10
1K
IC48B
5.6
15K
22K
.0068
.0068
560Ω
180K
18K
IC48C
8.2K
+14V
1M
.05
-13V
Flute 8
C6 - C7
C5 - C6
6.8K
IC41D
D125
22M
15K
Q85
68K
LOWER 8' FLUTE SWITCHER

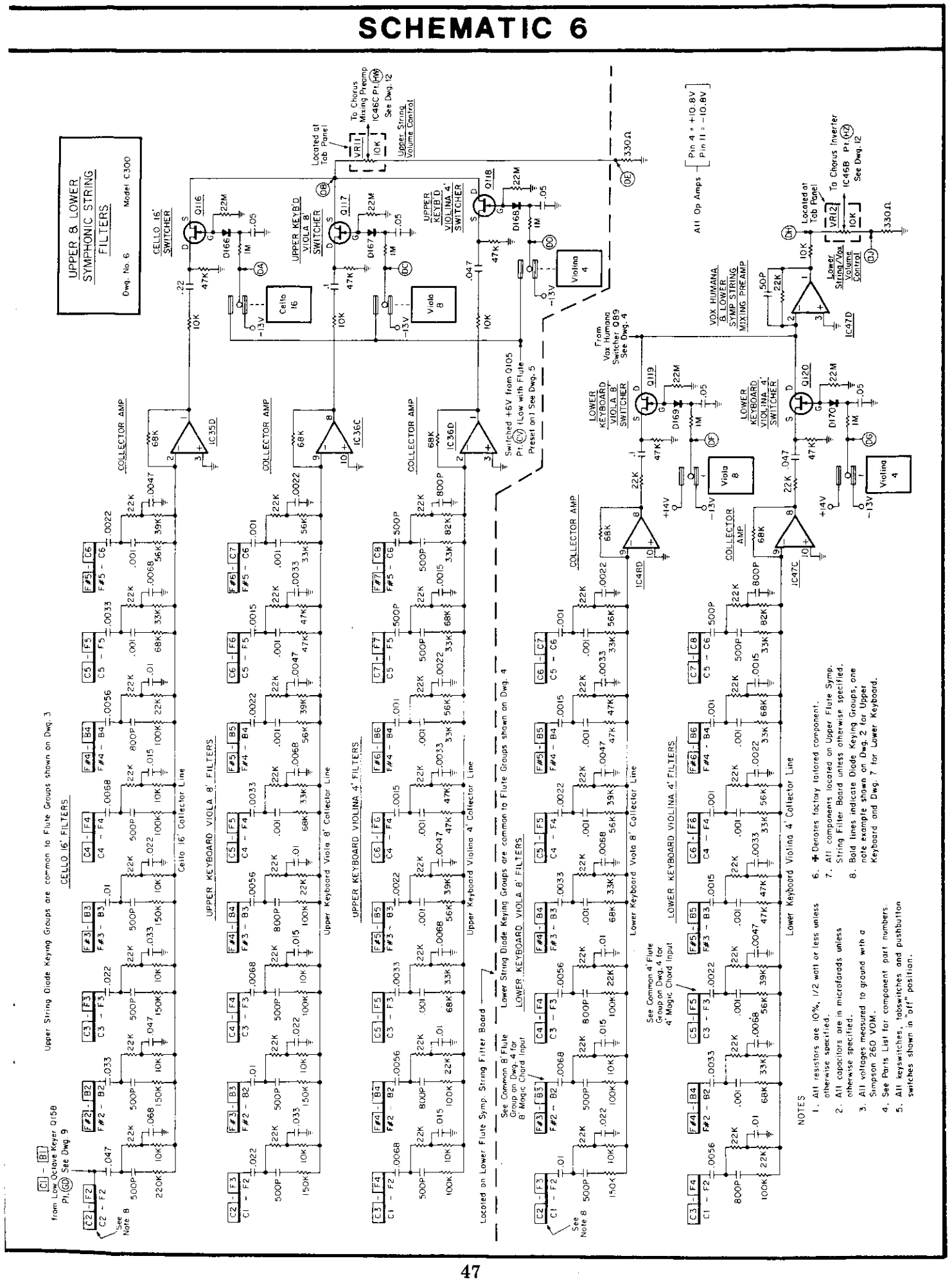
SCHEMATIC 5



NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. + Denotes factory tailored component.
7. All components located on D.C. Control Board unless otherwise specified.

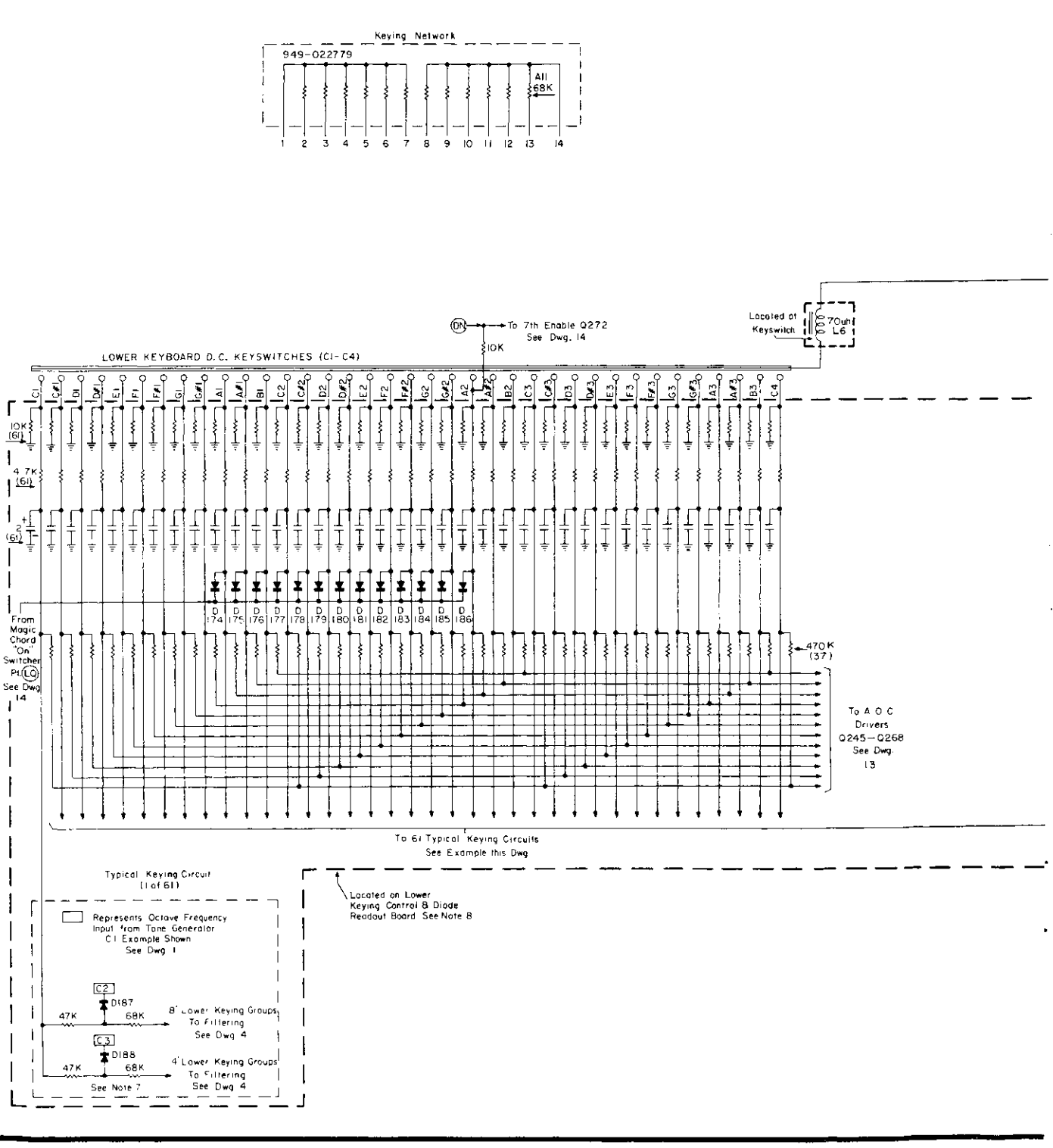
SCHEMATIC 6


UPPER & LOWER SYMPHONIC STRING FILTERS
Dwg. No. 6 Model C300
CELLO 16' SWITCHER
UPPER KEYB'D VIOLA 8' SWITCHER
UPPER KEYB'D VIOLINA 4' SWITCHER
LOWER KEYBOARD VIOLA 8' SWITCHER
LOWER KEYBOARD VIOLINA 4' SWITCHER
COLLECTOR AMP
VOX HUMANA & LOWER SYMP STRING MIXING PREAMP
All Op Amps Pin 4 = +10.8V Pin 11 = −10.8V
Located at Tab Panel
To Chorus Mixing Preamp IC46C Pin 14 See Dwg. 12
To Chorus Inverter IC46B Pin 6 See Dwg. 12
Upper String Volume Control
Lower String/Vox Volume Control
From Vox Humana Switches D89 See Dwg. 4
Switched +6V from Q105 Pin 7 (Low with Flute Preset on) See Dwg. 5
Upper String Diode Keying Groups are common to Flute Groups shown on Dwg. 3
from Low Octave Keyer Q158 Pin 6 See Dwg 9
CELLO 16' FILTERS
UPPER KEYBOARD VIOLA 8' FILTERS
UPPER KEYBOARD VIOLINA 4' FILTERS
Cello 16' Collector Line
Upper Keyboard Viola 8' Collector Line
Upper Keyboard Violina 4' Collector Line
Located on Lower Flute Symp. String Filter Board
Lower String Diode Keying Groups are common to Flute Groups shown on Dwg. 4
See Common 8' Flute Group on Dwg. 4 for 8' Magic Chord Input
See Common 4' Flute Group on Dwg. 4 for 4' Magic Chord Input
LOWER KEYBOARD VIOLA 8' FILTERS
LOWER KEYBOARD VIOLINA 4' FILTERS
Lower Keyboard Viola 8' Collector Line
Lower Keyboard Violina 4' Collector Line

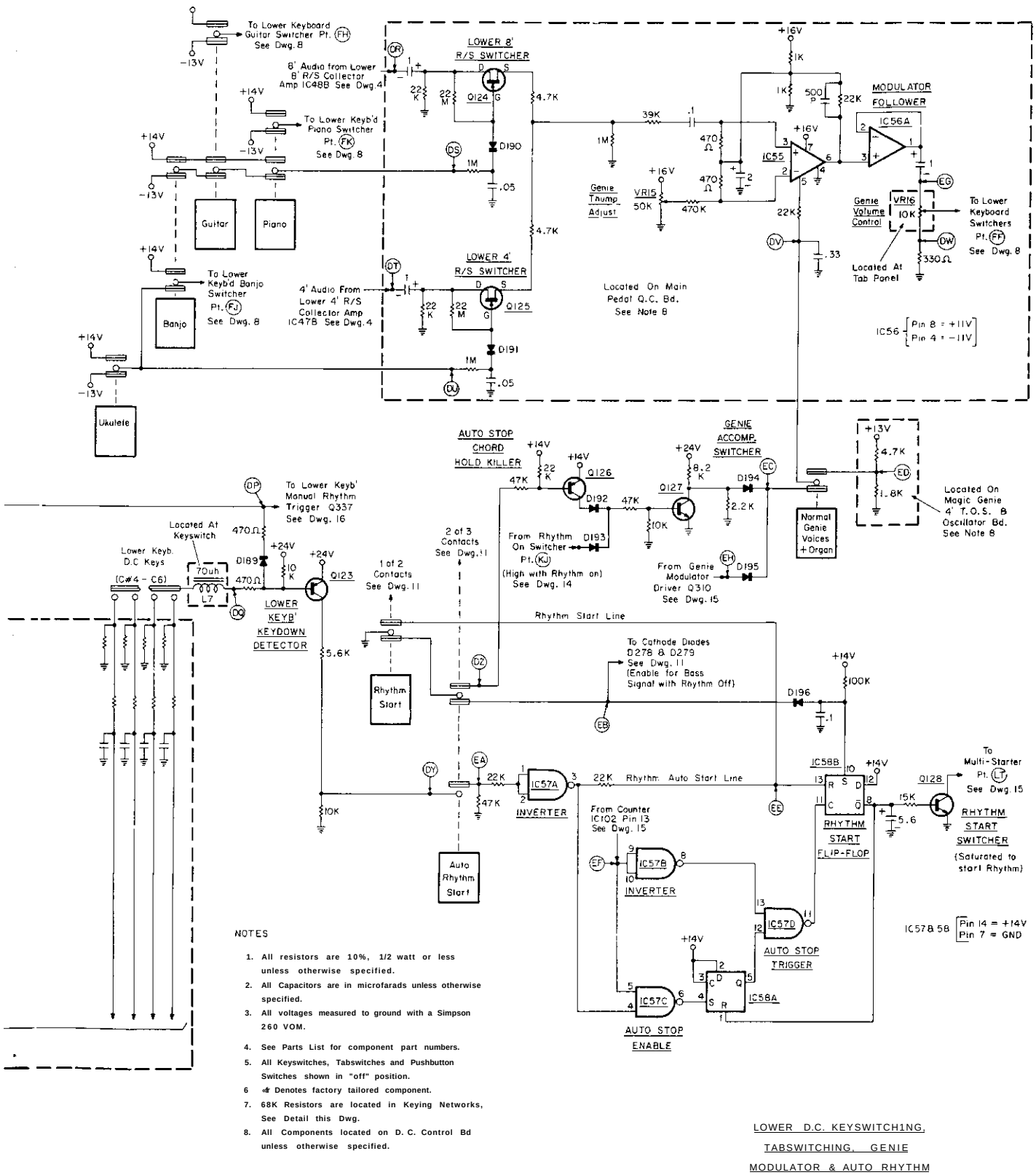
NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Upper Flute Symp. String Filter Board unless otherwise specified.
8. Bold lines indicate Diode Keying Groups, one note example shown on Dwg. 2 for Upper Keyboard and Dwg. 7 for Lower Keyboard.

SCHEMATIC 7


Keying Network
949-022779
All 68K
1 2 3 4 5 6 7 8 9 10 11 12 13 14
ON
To 7th Enable Q272 See Dwg. 14
10K
Located at Keyswitch
70uH L6
LOWER KEYBOARD D.C. KEYSWITCHES (C1-C4)
C1 C#1 D1 D#1 E1 F1 F#1 G1 G#1 A1 A#1 B1 C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4
10K (61)
4.7K (61)
2 (61)
D174 D175 D176 D177 D178 D179 D180 D181 D182 D183 D184 D185 D186
From Magic Chord "On" Switcher Pt. (LQ) See Dwg. 14
470K (37)
To A O C Drivers Q245-Q268 See Dwg. 13
To 61 Typical Keying Circuits See Example this Dwg
Typical Keying Circuit (1 of 61)
Represents Octave Frequency Input from Tone Generator C1 Example Shown See Dwg. 1
C2
D187
47K
68K
8' Lower Keying Groups To Filtering See Dwg. 4
C3
D188
47K
68K
4' Lower Keying Groups To Filtering See Dwg. 4
See Note 7
Located on Lower Keying Control & Diode Readout Board See Note 8

SCHEMATIC 7

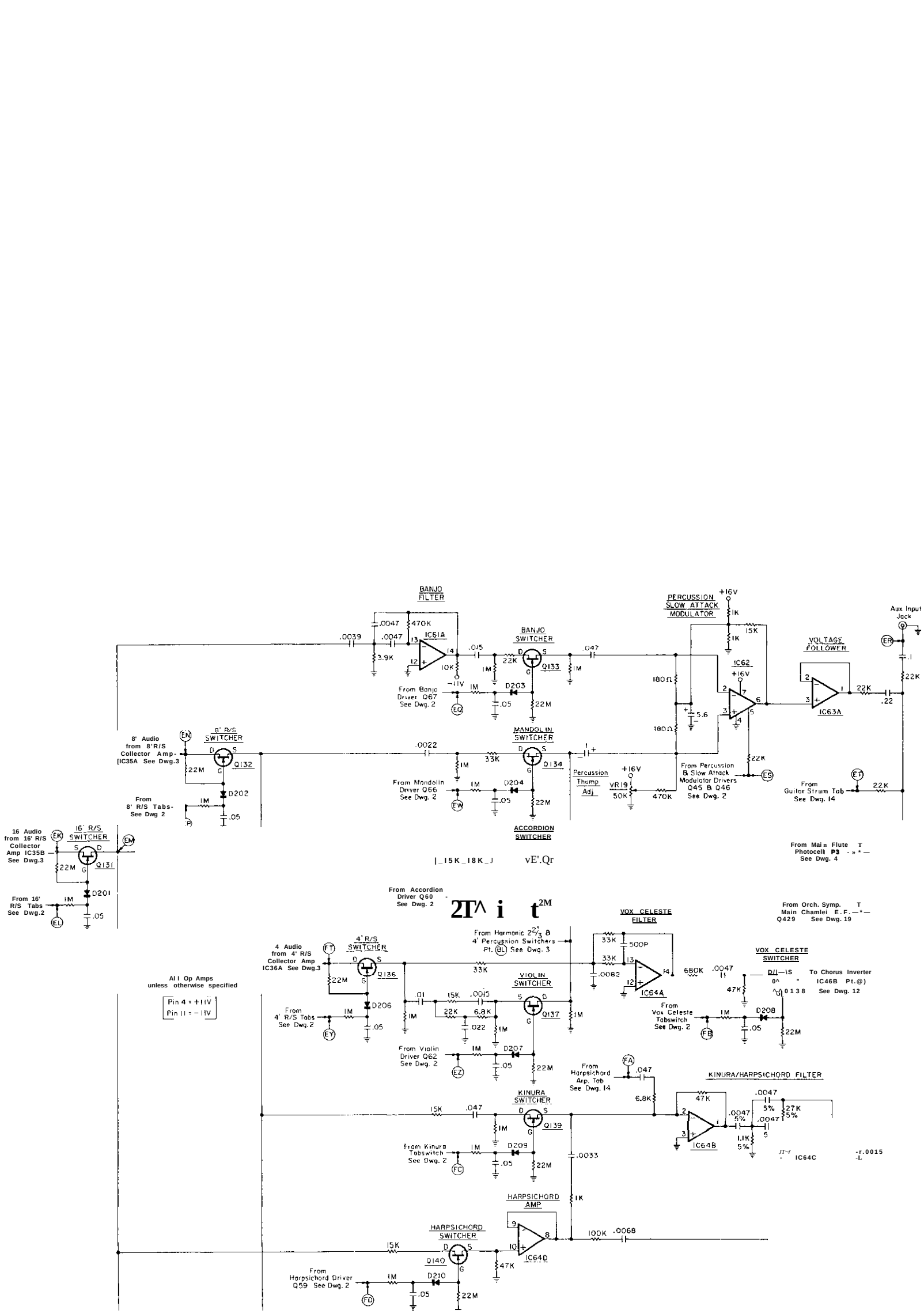


NOTES

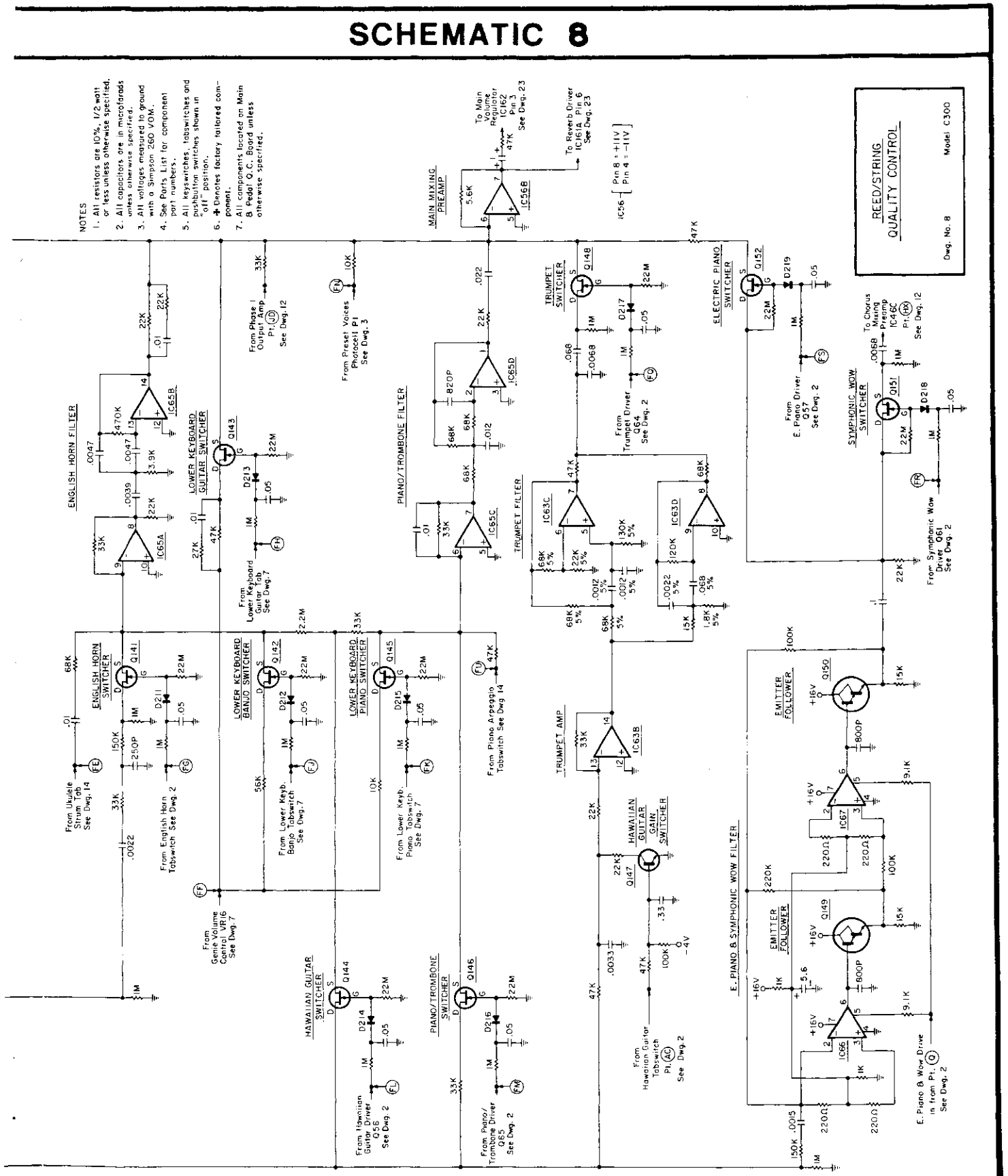
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ⊄ Denotes factory tailored component.
7. 68K Resistors are located in Keying Networks, See Detail this Dwg.
8. All Components located on D. C. Control Bd unless otherwise specified.

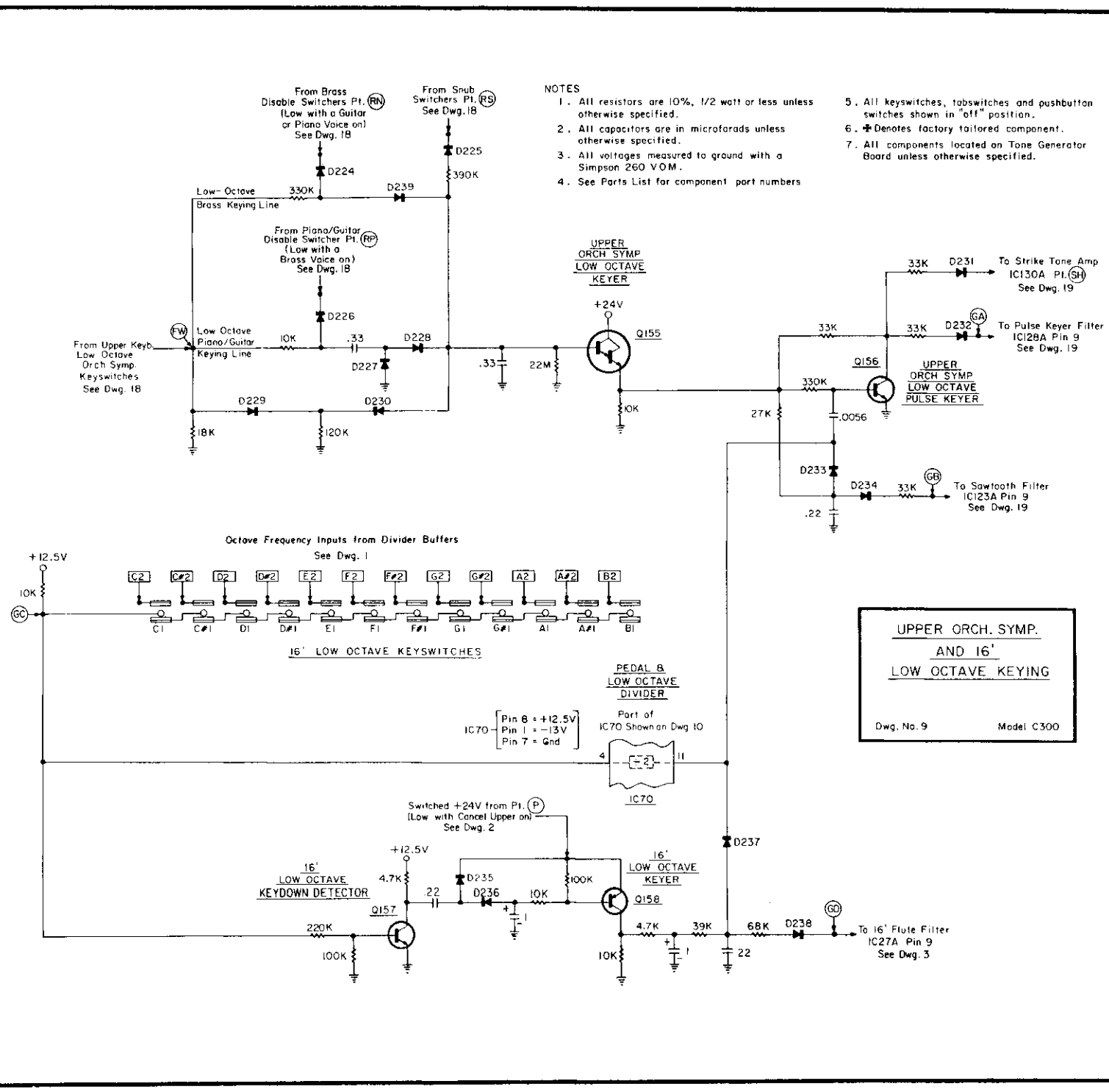
LOWER D.C. KEYSWITCHING, TABSWITCHING, GENIE MODULATOR & AUTO RHYTHM START

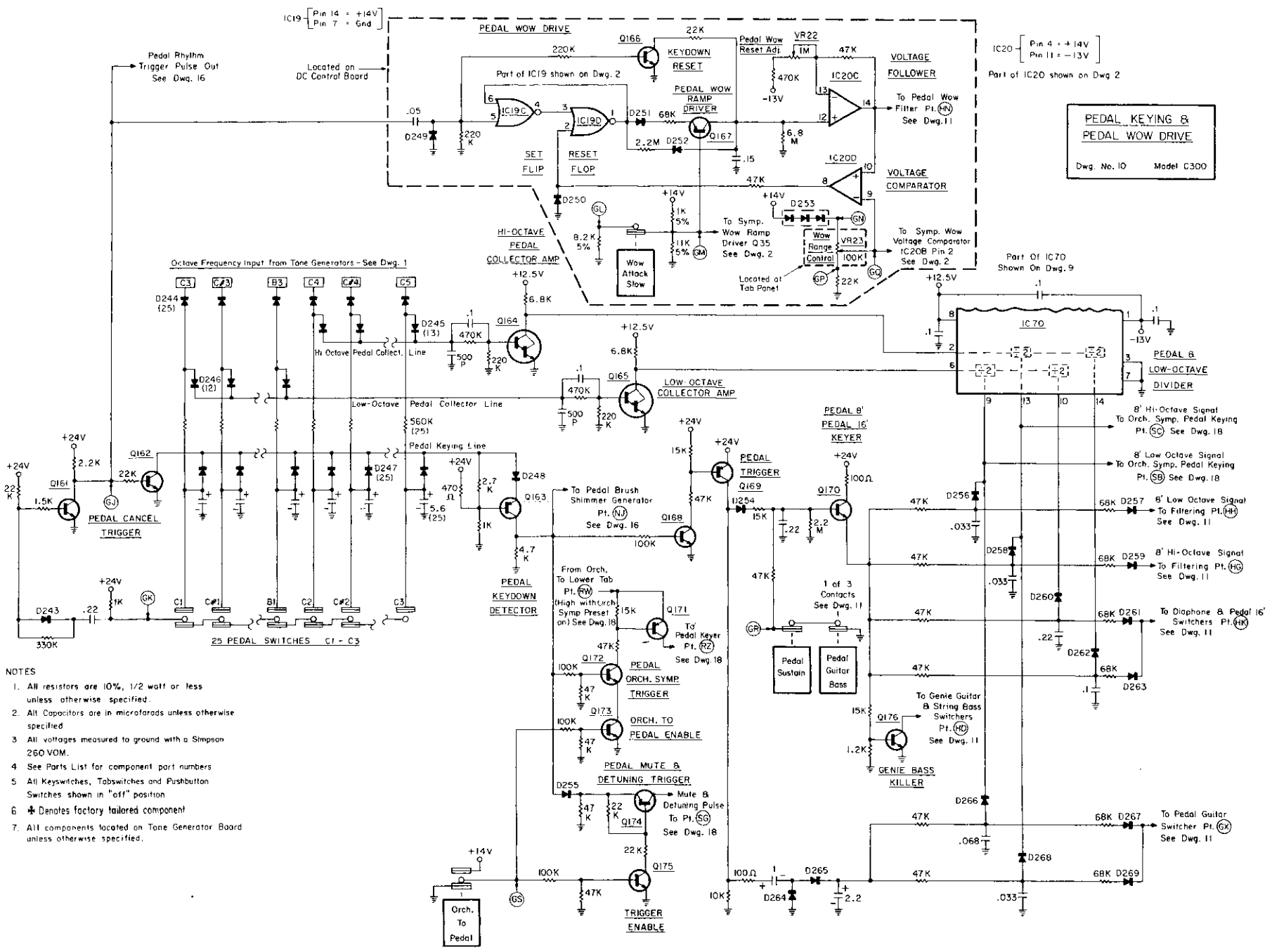
Dwg. No. 7 Model C300


BANJO FILTER
PERCUSSION SLOW ATTACK MODULATOR
+16V
Aux Input Jack
VOLTAGE FOLLOWER
BANJO SWITCHER
IC61A
IC62
IC63A
From Banjo Driver Q67 See Dwg. 2
8' Audio from 8'R/S Collector Amp- IC35A See Dwg.3
8' R/S SWITCHER
MANDOLIN SWITCHER
From 8' R/S Tabs- See Dwg 2
From Mandolin Driver Q66 See Dwg. 2
Percussion Thump Adj
From Percussion & Slow Attack Modulator Drivers Q45 & Q46 See Dwg. 2
From Guitar Strum Tab See Dwg. 14
16 Audio from 16' R/S Collector Amp IC35B See Dwg.3
16' R/S SWITCHER
From 16' R/S Tabs See Dwg.2
ACCORDION SWITCHER
From Main Flute T Photocell P3 See Dwg. 4
From Accordion Driver Q60 See Dwg. 2
VOX CELESTE FILTER
VOX CELESTE SWITCHER
From Harmonic 2 2/3 & 4' Percussion Switchers Pt. (BL) See Dwg. 3
From Orch. Symp. Main Chamlei E.F. Q429 See Dwg. 19
4 Audio from 4' R/S Collector Amp IC36A See Dwg.3
4' R/S SWITCHER
VIOLIN SWITCHER
From 4' R/S Tabs See Dwg.2
From Violin Driver Q62 See Dwg. 2
From Vox Celeste Tabswitch See Dwg. 2
To Chorus Inverter IC46B Pt.(@) See Dwg. 12
All Op Amps unless otherwise specified
Pin 4 = +11V
Pin 11 = -11V
From Harpsichord Arp. Tab See Dwg. 14
KINURA SWITCHER
KINURA/HARPSICHORD FILTER
From Kinura Tabswitch See Dwg. 2
HARPSICHORD AMP
HARPSICHORD SWITCHER
From Harpsichord Driver Q59 See Dwg. 2

SCHEMATIC 8


NOTES
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and rotary switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Main & Pedal P.C. Board unless otherwise specified.
REED/STRING QUALITY CONTROL
Dwg. No. 8
Model C300
MAIN MIXING PREAMP
To Main Volume Regulator IC162 Pin 3 See Dwg. 23
To Reverb Driver IC161A Pin 6 See Dwg. 23
IC56 Pin 8 = +11V Pin 4 = -11V
ENGLISH HORN FILTER
LOWER KEYBOARD GUITAR SWITCHER
PIANO/TROMBONE FILTER
TRUMPET FILTER
TRUMPET SWITCHER
ELECTRIC PIANO SWITCHER
SYMPHONIC WOW SWITCHER
ENGLISH HORN SWITCHER
LOWER KEYBOARD BANJO SWITCHER
LOWER KEYBOARD PIANO SWITCHER
HAWAIIAN GUITAR SWITCHER
PIANO/TROMBONE SWITCHER
HAWAIIAN GUITAR GAIN SWITCHER
TRUMPET AMP
E. PIANO & SYMPHONIC WOW FILTER
EMITTER FOLLOWER
From Preset Voices Photocell P1 See Dwg. 3
From Phase I Output Amp P1 See Dwg. 12
From Lower Keyboard Guitar Tab See Dwg. 7
From Trumpet Driver Q64 See Dwg. 2
From E. Piano Driver Q57 See Dwg. 2
To Chorus Mixing Preamp IC46C P1 See Dwg. 12
From Symphonic Wow Driver Q61 See Dwg. 2
From Ukulele Tabswitch See Dwg. 14
From English Horn Tabswitch See Dwg. 2
From Lower Keyb. Banjo Tabswitch See Dwg. 7
From Lower Keyb. Piano Tabswitch See Dwg. 7
From Piano Arpeggio Tabswitch See Dwg. 14
From Genie Volume Control VR16 See Dwg. 7
From Hawaiian Guitar Driver Q56 See Dwg. 2
From Piano/ Trombone Driver Q55 See Dwg. 2
From Hawaiian Guitar Tabswitch P1 See Dwg. 2
E. Piano & Wow Drive in from P1 See Dwg. 2

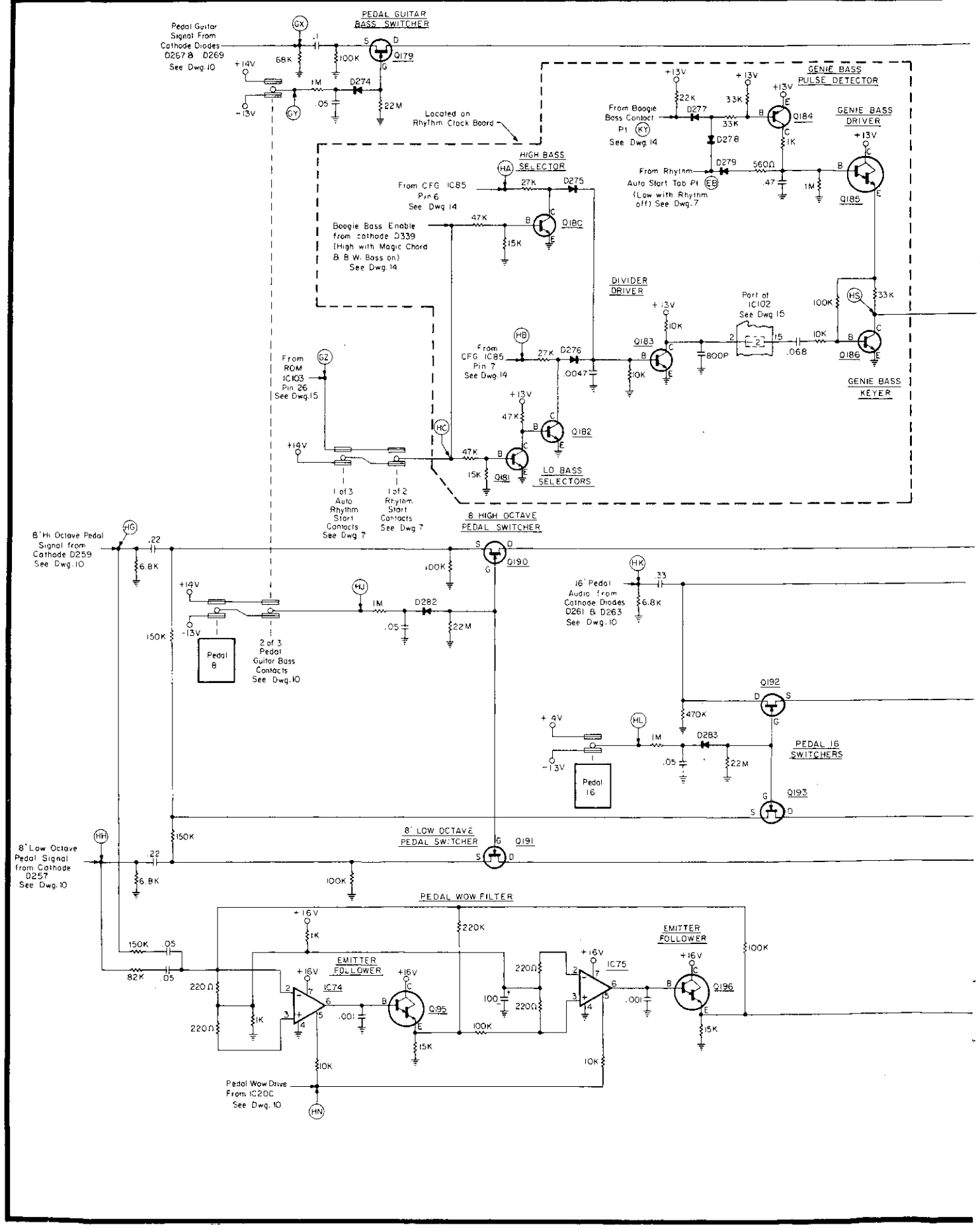

From Brass Disable Switchers Pt. RN (Low with a Guitar or Piano Voice on) See Dwg. 18
From Snub Switchers Pt. RS See Dwg. 18
D224
D225
390K
Low-Octave Brass Keying Line
330K
D239
From Piano/Guitar Disable Switcher Pt. RP (Low with a Brass Voice on) See Dwg. 18
D226
From Upper Keyb. Low Octave Orch Symp. Keyswitches See Dwg. 18
FW
Low Octave Piano/Guitar Keying Line
10K
.33
D228
D227
D229
D230
18K
120K
.33
22M
UPPER ORCH SYMP LOW OCTAVE KEYER
+24V
Q155
10K
33K
D231
To Strike Tone Amp IC130A Pt. SH See Dwg. 19
33K
33K
D232
GA
To Pulse Keyer Filter IC128A Pin 9 See Dwg. 19
Q156
UPPER ORCH SYMP LOW OCTAVE PULSE KEYER
330K
27K
.0056
D233
D234
33K
GB
To Sawtooth Filter IC123A Pin 9 See Dwg. 19
.22
NOTES
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✠ Denotes factory tailored component.
7. All components located on Tone Generator Board unless otherwise specified.
Octave Frequency Inputs from Divider Buffers
See Dwg. 1
+12.5V
10K
GC
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2
C1 C#1 D1 D#1 E1 F1 F#1 G1 G#1 A1 A#1 B1
16' LOW OCTAVE KEYSWITCHES
PEDAL 8 LOW OCTAVE DIVIDER
IC70
Pin 8 = +12.5V
Pin 1 = −13V
Pin 7 = Gnd
Part of IC70 Shown on Dwg 10
4
11
IC70
Switched +24V from Pt. P (Low with Cancel Upper on) See Dwg. 2
D237
+12.5V
16' LOW OCTAVE KEYDOWN DETECTOR
4.7K
22
D235
D236
10K
100K
16' LOW OCTAVE KEYER
Q158
Q157
220K
100K
4.7K
39K
68K
D238
GD
To 16' Flute Filter IC27A Pin 9 See Dwg. 3
10K
22
UPPER ORCH. SYMP. AND 16' LOW OCTAVE KEYING
Dwg. No. 9
Model C300



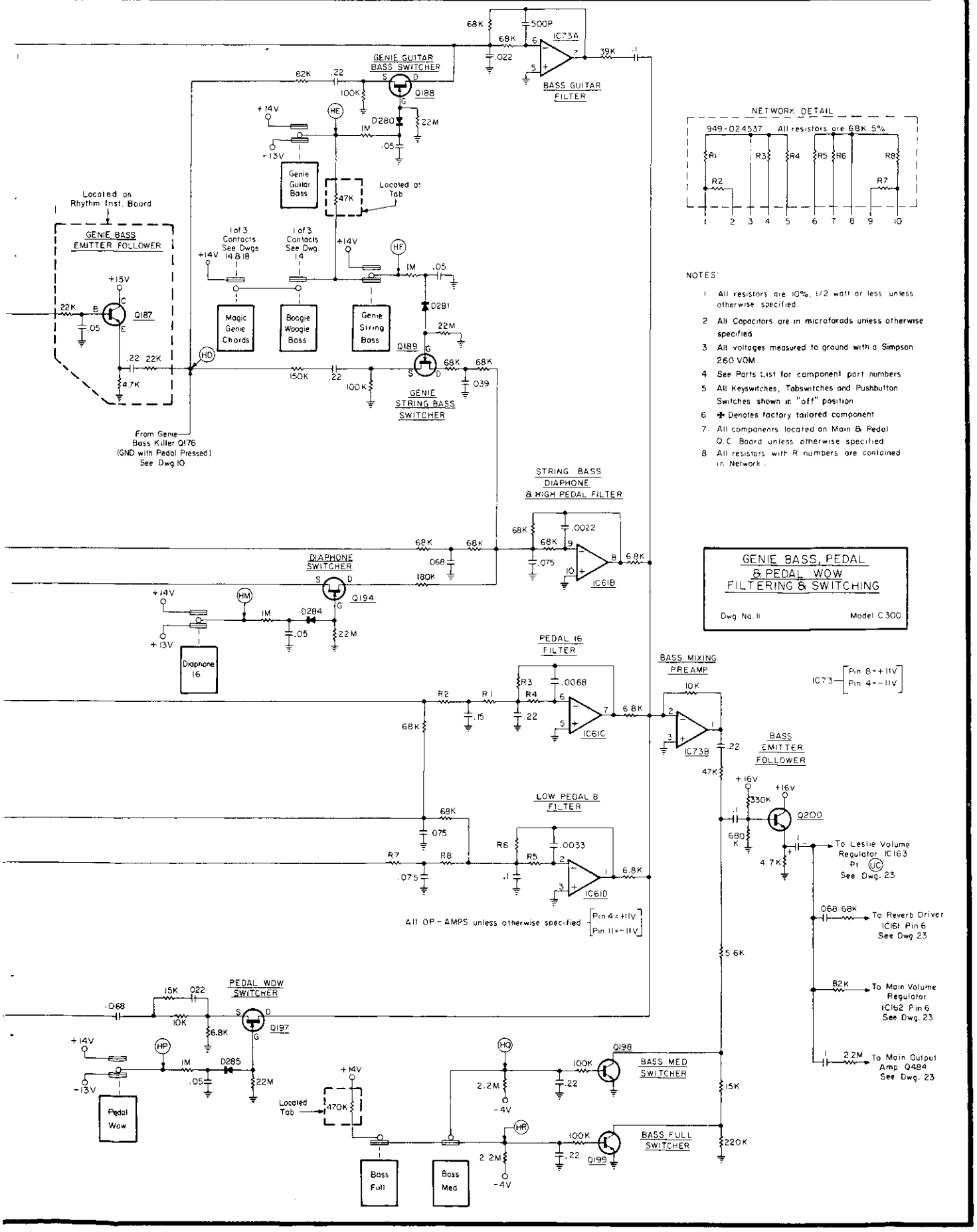
NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. ✣ Denotes factory tailored component
7. All components located on Tone Generator Board unless otherwise specified.

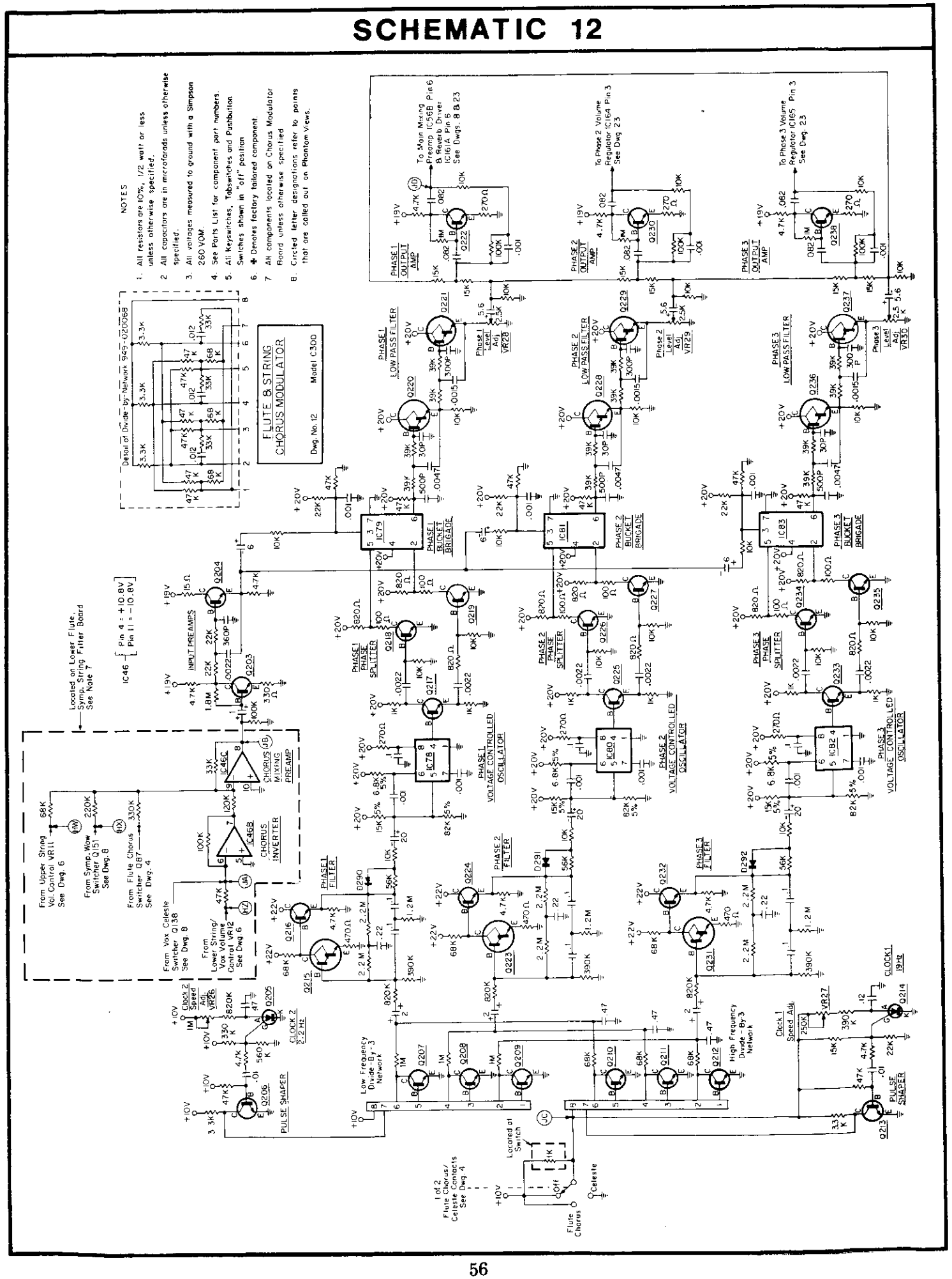
SCHEMATIC 11



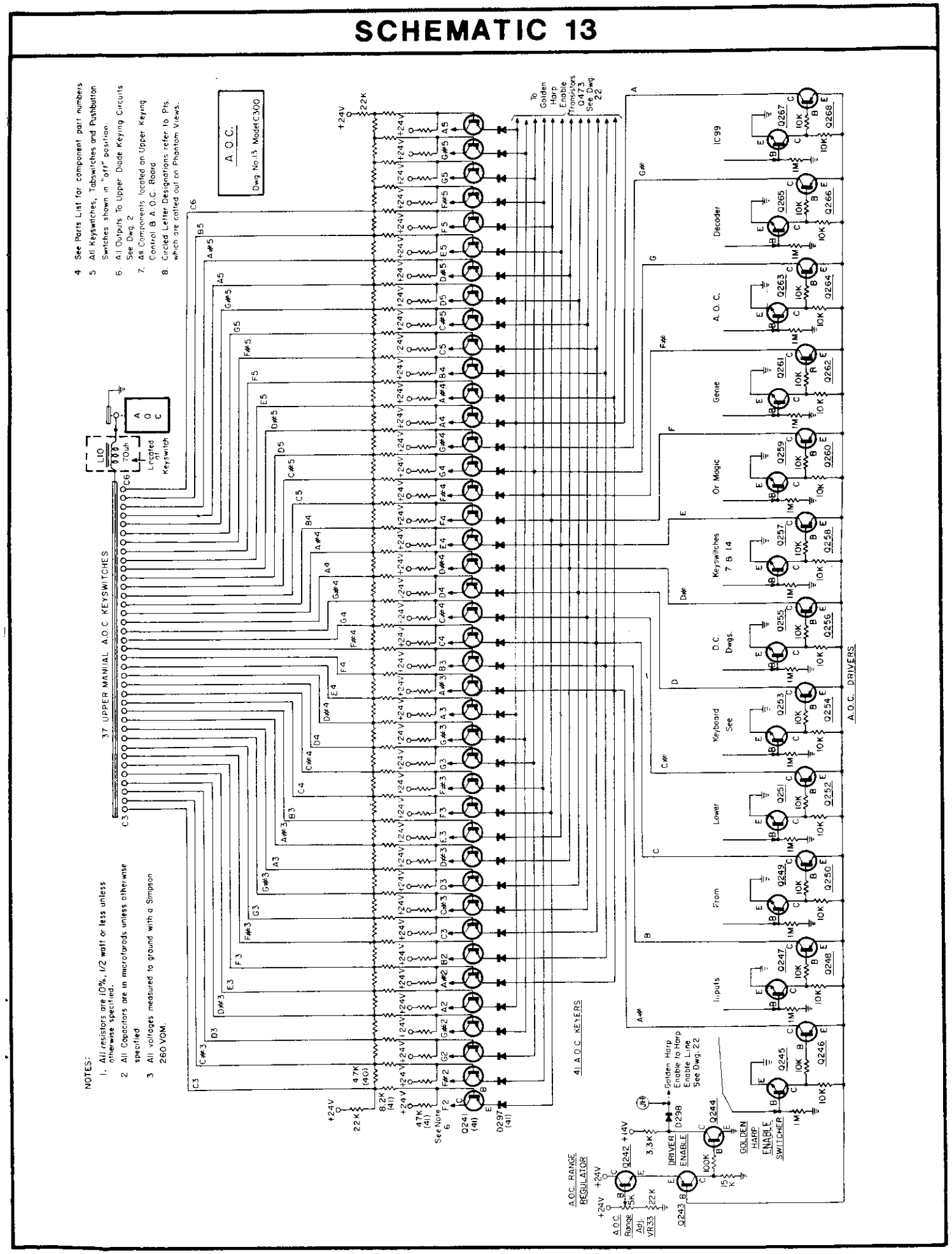
SCHEMATIC 11


GENIE GUITAR BASS SWITCHER
BASS GUITAR FILTER
IC73A
Q188
D280
Genie Guitar Bass
Located at Tab
Located on Rhythm Inst. Board
GENIE BASS EMITTER FOLLOWER
Q187
Magic Genie Chords
Boogie Woogie Bass
Genie String Bass
D281
Q189
GENIE STRING BASS SWITCHER
From Genie Bass Killer Q176 (GND with Pedal Pressed) See Dwg.10
STRING BASS DIAPHONE & HIGH PEDAL FILTER
IC61B
DIAPHONE SWITCHER
Q194
D284
Diaphone 16
PEDAL 16 FILTER
IC61C
LOW PEDAL 8 FILTER
IC61D
All OP-AMPS unless otherwise specified
Pin 4=+11V
Pin 11=-11V
BASS MIXING PREAMP
IC73B
IC73
Pin 8=+11V
Pin 4=-11V
BASS EMITTER FOLLOWER
Q200
To Leslie Volume Regulator IC163 P1 See Dwg. 23
To Reverb Driver IC161 Pin 6 See Dwg 23
To Main Volume Regulator IC162 Pin 6 See Dwg. 23
To Main Output Amp Q484 See Dwg. 23
PEDAL WOW SWITCHER
Q197
Pedal Wow
Boss Full
Boss Med
Q198
BASS MED SWITCHER
Q199
BASS FULL SWITCHER
NETWORK DETAIL
949-024537 All resistors are 68K 5%
NOTES:
1 All resistors are 10%, 1/2 watt or less unless otherwise specified.
2 All Capacitors are in microfarads unless otherwise specified
3 All voltages measured to ground with a Simpson 260 VOM.
4 See Parts List for component part numbers
5 All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6 ✠ Denotes factory tailored component
7 All components located on Main & Pedal Q.C Board unless otherwise specified
8 All resistors with R numbers are contained in Network.
GENIE BASS, PEDAL & PEDAL WOW FILTERING & SWITCHING
Dwg. No. 11
Model C 300

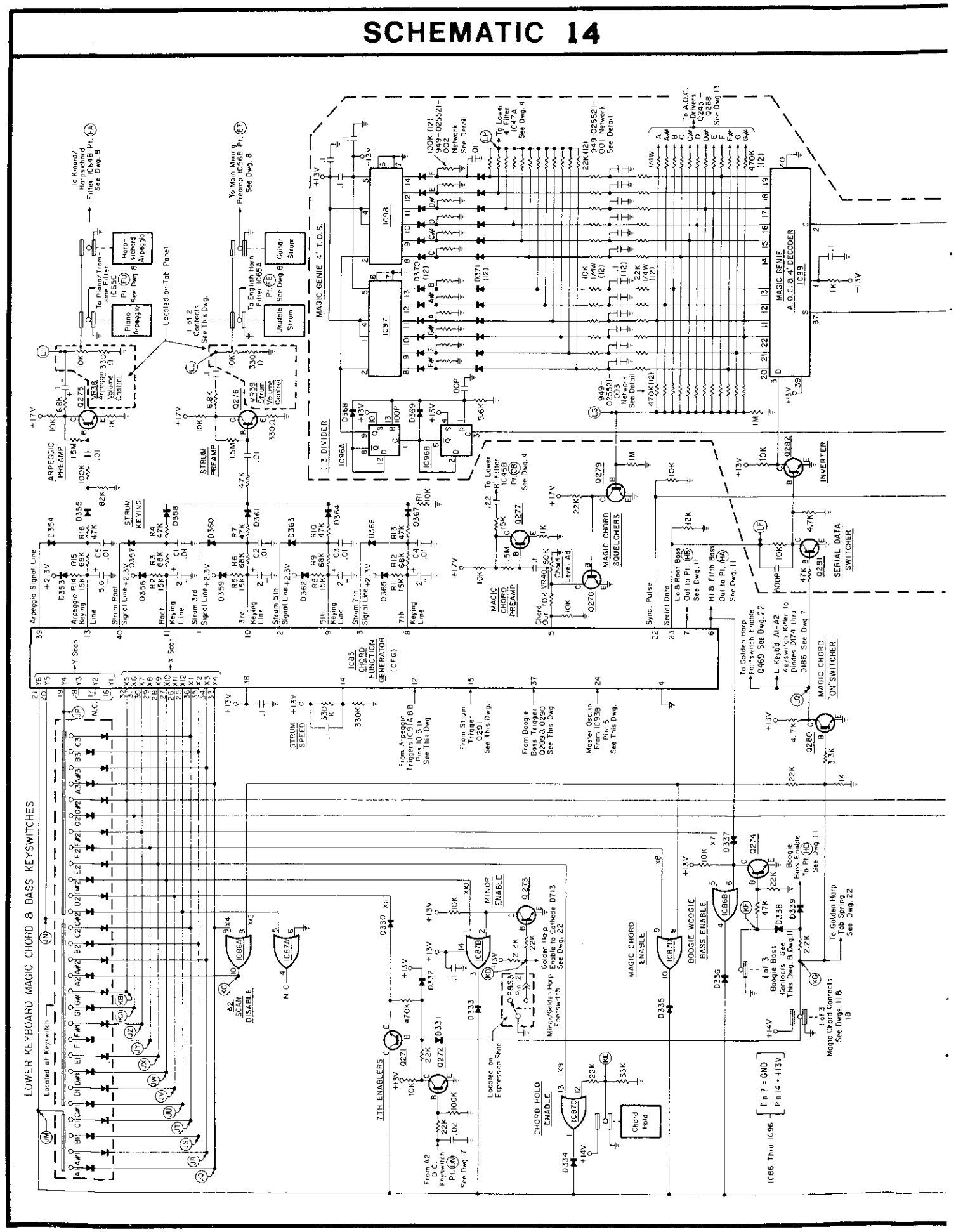
SCHEMATIC 12


NOTES
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. ✱ Denotes factory tailored component
7. All components located on Chorus Modulator Board unless otherwise specified
8. Circled letter designations refer to points that are called out on Phantom Views.
FLUTE & STRING CHORUS MODULATOR
Dwg. No. 12 Model C-300
Detail of Divide-by-Network 945-020065
Located on Lower Flute, Symp. String Filter Board See Note 7
IC46 Pin 4 = +10.8V Pin 11 = -10.8V
INPUT PREAMPS
PHASE 1 OUTPUT AMP
PHASE 2 OUTPUT AMP
PHASE 3 OUTPUT AMP
To Main Mixing Preamp IC56B Pin 6 & Reverb Driver IC56A Pin 5 See Dwgs. 8 & 23
To Phase 2 Volume Regulator IC164 Pin 3 See Dwg. 23
To Phase 3 Volume Regulator IC165 Pin 3 See Dwg. 23
PHASE 1 LOW PASS FILTER
PHASE 2 LOW PASS FILTER
PHASE 3 LOW PASS FILTER
Phase 1 Level Adj. VR28
Phase 2 Level Adj. VR29
Phase 3 Level Adj. VR30
PHASE 1 BUCKET BRIGADE
PHASE 2 BUCKET BRIGADE
PHASE 3 BUCKET BRIGADE
PHASE 1 PHASE SPLITTER
PHASE 2 PHASE SPLITTER
PHASE 3 PHASE SPLITTER
PHASE 1 VOLTAGE CONTROLLED OSCILLATOR
PHASE 2 VOLTAGE CONTROLLED OSCILLATOR
PHASE 3 VOLTAGE CONTROLLED OSCILLATOR
CHORUS MIXING PREAMP
CHORUS INVERTER
From Upper String Vol. Control VR11 See Dwg. 6
From Symp. Wow Switches S51 See Dwg. 8
From Flute Chorus Switches S67 See Dwg. 4
From Vox Celeste Switches S138 See Dwg. 8
From Lower String/ Vox Volume Control VR12 See Dwg. 6
PHASE 1 FILTER
PHASE 2 FILTER
PHASE 3 FILTER
Clock 2 Speed Adj. VR26
CLOCK 2 2.22 Hz
PULSE SHAPER
Low Frequency Divide-By-3 Network
High Frequency Divide-By-3 Network
Clock 1 Speed Adj. VR27
CLOCK 1 8Hz
PULSE SHAPER
Located at Switch
1 of 2 Flute Chorus/ Celeste Contacts See Dwg. 4
Off
Flute Chorus
Celeste

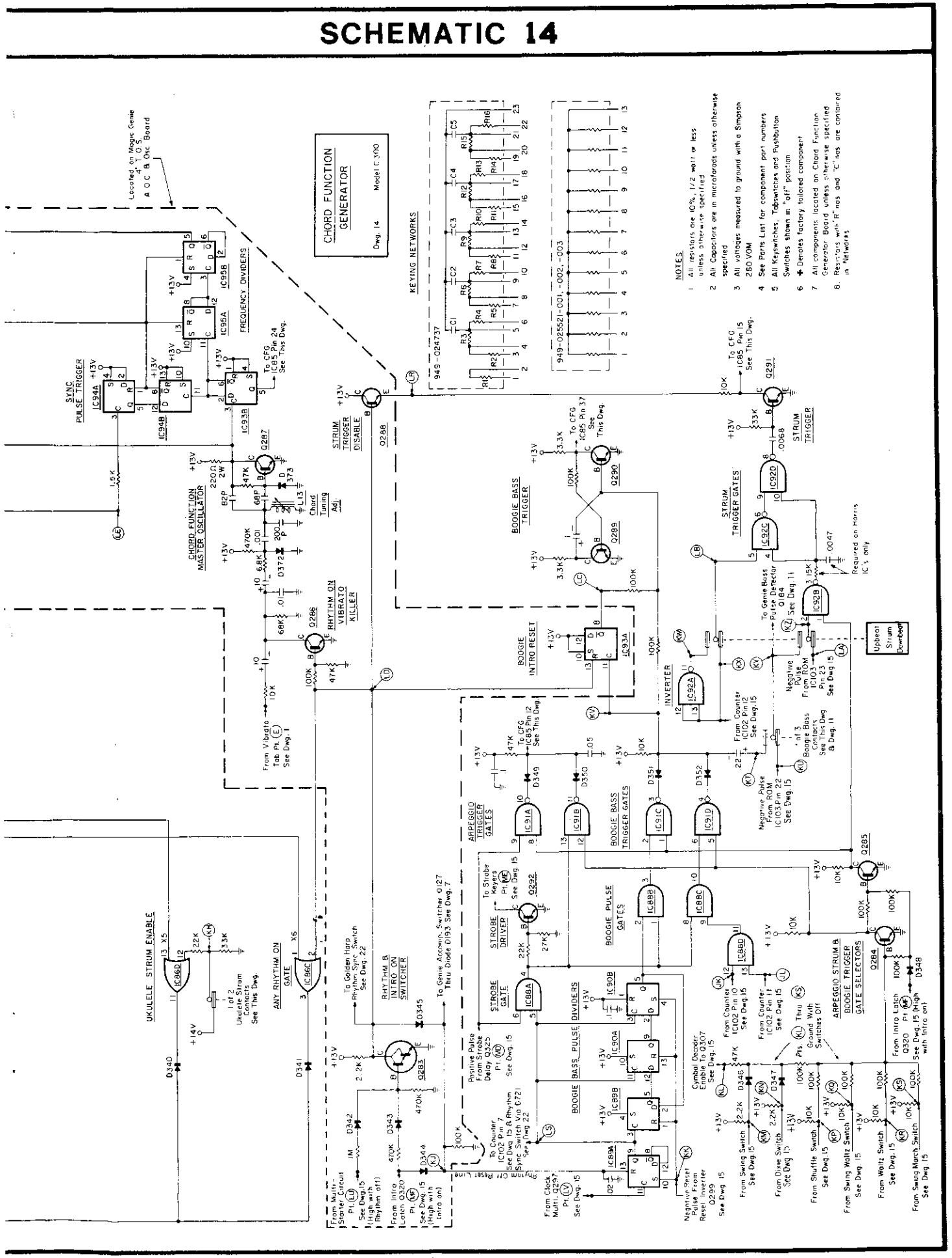
SCHEMATIC 13


NOTES:
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and PushButton Switches shown in "off" position.
6. All Outputs To Upper Diode Keying Circuits See Dwg. 2
7. All Components located on Upper Keying Control B A.O.C. Board
8. Circled Letter Designations refer to Pts. which are called out on Phantom Views.
A. O. C.
Dwg No.13 Model C300
37 UPPER MANUAL A.O.C KEYSWITCHES
41 A.O.C KEYERS
A.O.C. DRIVERS
A.O.C. RANGE REGULATOR
GOLDEN HARP ENABLE SWITCHER
To Golden Harp Enable Transistors D473 See Dwg 22
Golden Harp Enable to Harp Enable Line See Dwg. 22
Keyboard
Inputs
From
Lower
Keyswitches 7 & 14
Or Magic
Genie
A. O. C.
Decoder
IC99
Located at Keyswitch
LIO
70uh
C61

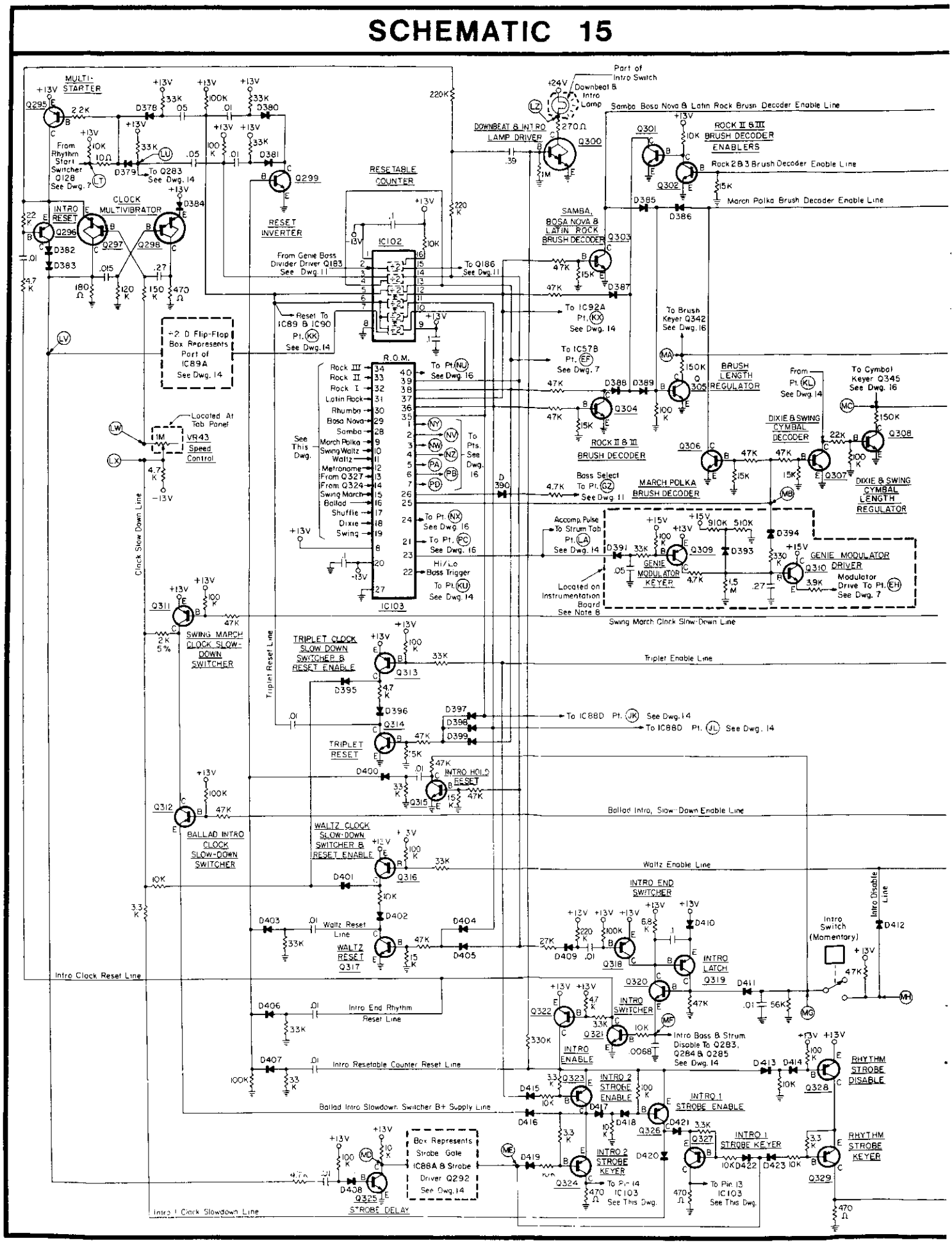
SCHEMATIC 14


MAGIC GENIE 4' T.O.S.
÷3 DIVIDER
ARPEGGIO PREAMP
STRUM PREAMP
MAGIC CHORD PREAMP
MAGIC GENIE A.O.C. & 4' DECODER IC99
INVERTER
SERIAL DATA SWITCHER
LOWER KEYBOARD MAGIC CHORD & BASS KEYSWITCHES
IC85 CHORD FUNCTION GENERATOR (CFG)
STRUM KEYING
MAGIC CHORD SQUELCHERS
STRUM SPEED
Chord Hold
Golden Harp Enable to Cathode D713 See Dwg. 22
MINOR ENABLE
MAGIC CHORD ENABLE
BOOGIE WOOGIE BASS ENABLE
CHORD HOLD ENABLE
7TH ENABLERS
A2 SCAN DISABLE
MAGIC CHORD ON SWITCHER
Located on Tab Panel
Located at Keyswitch
1 of 2 Contacts See This Dwg.
1 of 3 Boogie Bass Contacts See This Dwg. & Dwg. 11
1 of 3 Magic Chord Contacts See Dwgs. 11 & 18
Pin 7 = GND
Pin 14 = +13V
IC86 Thru IC96
To Knott/Harpsichord Filter IC64B Pl. (FA) See Dwg. 8
To Main Mixing Preamp IC56B Pl. (E) See Dwg. 8
To Lower 4' Filter IC47A See Dwg. 4
To Lower B' Filter IC45B See Dwg. 4
To A.O.C. Drivers Q293 - Q298 See Dwg. 13
To Golden Harp Tab Switch Enable Q469 See Dwg. 22
To Keyboard Interconnect Plug
Harpsichord Arpeggio
Piano Arpeggio
Guitar Strum
Ukulele Strum
Arpeggio Volume Control
Strum Volume Control
Chord Level Adj.
Boogie Bass Volume
Boogie Bass Enable To Pl. (HS) See Dwg. 11
Golden Harp Sustain
Golden Harp Volume
Minor/Golden Harp Footswitch
PASS Pin 12
From Arpeggio Triggers IC91A B8 Pins 10 B 11 See This Dwg.
From Strum Trigger Q284 See This Dwg.
From Boogie Bass Trigger Q299B, Q292 See This Dwg.
Master Osc. In From IC93B Pin 5 See This Dwg.
From A2 Keyswitch Pl. (DN) See Dwg. 7
949-02552I-001 Network See Detail
949-02552I-002 Network See Detail
949-02552I-003 Network See Detail
Arpeggio Signal Line
Strum Root Signal Line
Strum 3rd Signal Line
Strum 5th Signal Line
Strum 7th Signal Line
Sync Pulse
Serial Data Lo & Rest Bass Out to Pl. (HS) See Dwg. 11
Hi & Fifth Bass Out to Pl. (HS) See Dwg. 11
Y Scan
X Scan

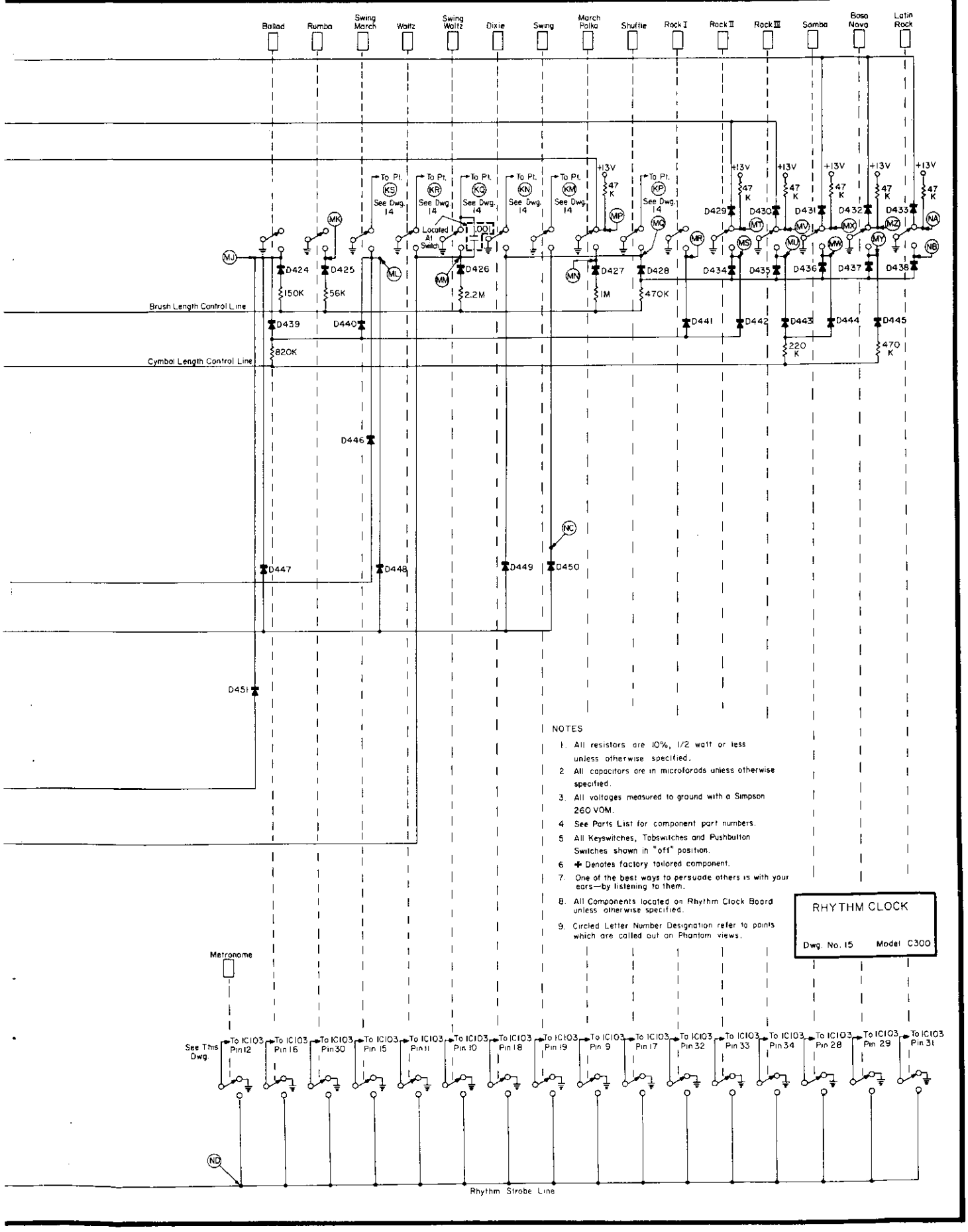
SCHEMATIC 14


CHORD FUNCTION GENERATOR
Dwg. 14 Model FC-1010
KEYING NETWORKS
949-024737
949-025521-001, -002, -003
NOTES:
1 All resistors are 10%, 1/2 watt or less unless otherwise specified
2 All Capacitors are in microfarads unless otherwise specified
3 All voltages measured to ground with a Simpson 260 VOM
4 See Parts List for component part numbers
5 All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6 ✱ Denotes factory tailored component
7 All components located on Chord Function Generator Board unless otherwise specified
8 Resistors with R nos. and C nos. are contained in Networks
Located on Magic Genie A.O.C. & Osc. Board
FREQUENCY DIVIDERS
SYNC PULSE TRIGGER
CHORD FUNCTION MASTER OSCILLATOR
Chord Tuning Adj.
RHYTHM ON VIBRATO KILLER
STRUM TRIGGER DISABLE
BOOGIE BASS TRIGGER
BOOGIE INTRO RESET
STRUM TRIGGER GATES
INVERTER
ARPEGGIO TRIGGER GATES
BOOGIE BASS TRIGGER GATES
STROBE DRIVER
STROBE GATE
STROBE DIVIDERS
BOOGIE PULSE GATES
BOOGIE BASS PULSE
ARPEGGIO/STRUM B BOOGIE TRIGGER GATE SELECTORS
RHYTHM B INTRO ON SWITCHER
ANY RHYTHM ON GATE
UKULELE STRUM ENABLE
To CFG IC85 Pin 24 See This Dwg
To CFG IC85 Pin 37 See This Dwg
To CFG IC85 Pin 15 See This Dwg.
To CFG IC85 Pin 12 See This Dwg
To Genie Bass Pulse Detector Q184 See Dwg 11
To Golden Harp Rhythm Sync Switch See Dwg 22
To Genie Accomp. Switcher Q127 Thru Diode D193 See Dwg. 7
To Strobe Keyers Pt (ME) See Dwg 15
From Vibrato Tab Pt (E) See Dwg. 1
From Multi-Shorter Circuit Pt (JM) See Dwg 15 (High with Rhythm off)
From Intro Latch Q320 Pt (ME) See Dwg 15 (High with Intro on)
From Intro Latch Q320 Pt (ME) See Dwg 15 (High with Intro on)
From Clock Multi Q297 Pt (LV) See Dwg 15
From Counter IC102 Pin 7 See Dwg 22
From Counter IC102 Pin 10 See Dwg 15
From Counter IC102 Pin 11 See Dwg 15
From Counter IC102 Pin 12 See Dwg 15
Negative Pulse From ROM IC103 Pin 22 See Dwg 15
Negative Pulse From ROM IC103 Pin 23 See Dwg 15
Negative Reset Pulse From Reset Inverter Q299 See Dwg 15
Cymbal Decoder Enable To Q307 See Dwg 15
From Swing Switch See Dwg 15
From Dixie Switch See Dwg 15
From Shuffle Switch See Dwg 15
From Swing Waltz Switch See Dwg 15
From Waltz Switch See Dwg 15
From Swing March Switch See Dwg 15
Thru (KS) Ground With Switches Off
Required on Horns IC's only
Upbeat Strum Enable
1 of 3 Boogie Bass Contacts See This Dwg & Dwg 11
1 of 2 Ukulele Strum Contacts See This Dwg
Positive Pulse From Strobe Delay Q325 Pt (ME) See Dwg 15
To Counter IC102 Pin 7 See Dwg 22
Q288
Q287
Q289
Q290
Q291
Q292
Q285
Q284
Q286
Q345
D340
D341
D342
D343
D344
D345
D346
D347
D348
D349
D350
D351
D352
D372
D373
IC94B
IC94A
IC95B
IC95A
IC95C
IC93B
IC93A
IC91A
IC91B
IC91C
IC91D
IC88A
IC88B
IC88C
IC88D
IC90B
IC90A
IC89B
IC89A
IC86A
IC86B
IC86C
IC92A
IC92B
IC92C
IC92D
IC102
IC103

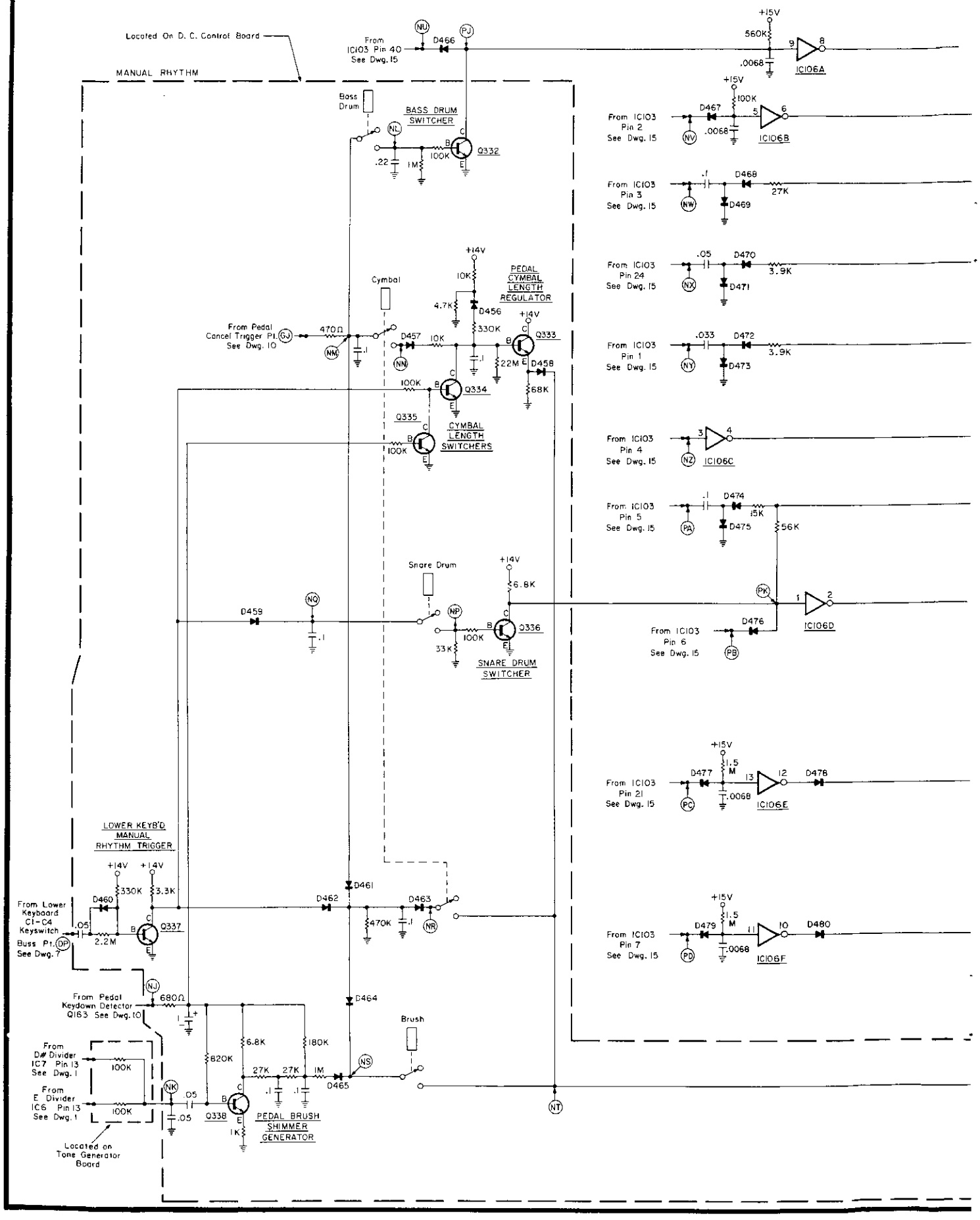
SCHEMATIC 15



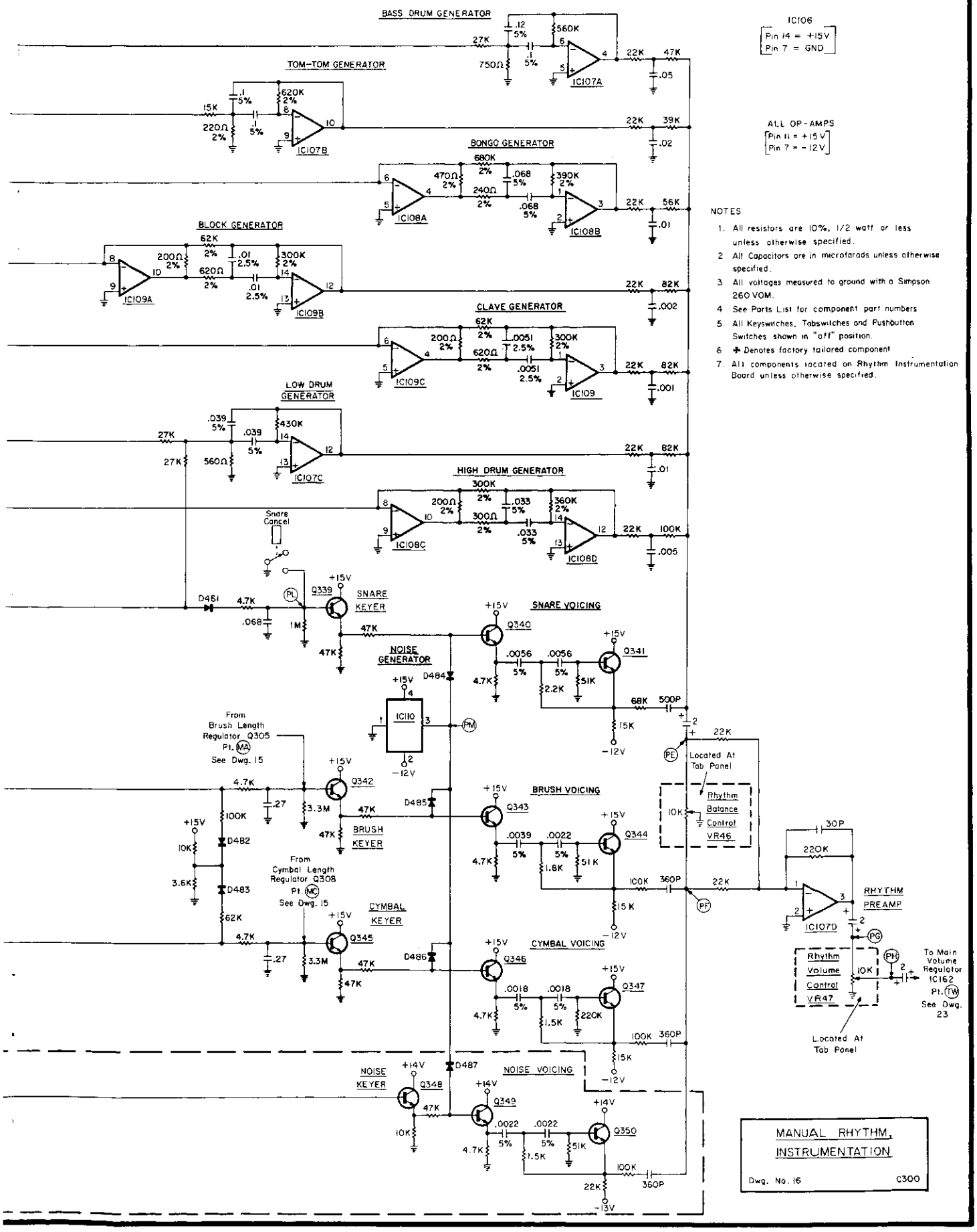
SCHEMATIC 15



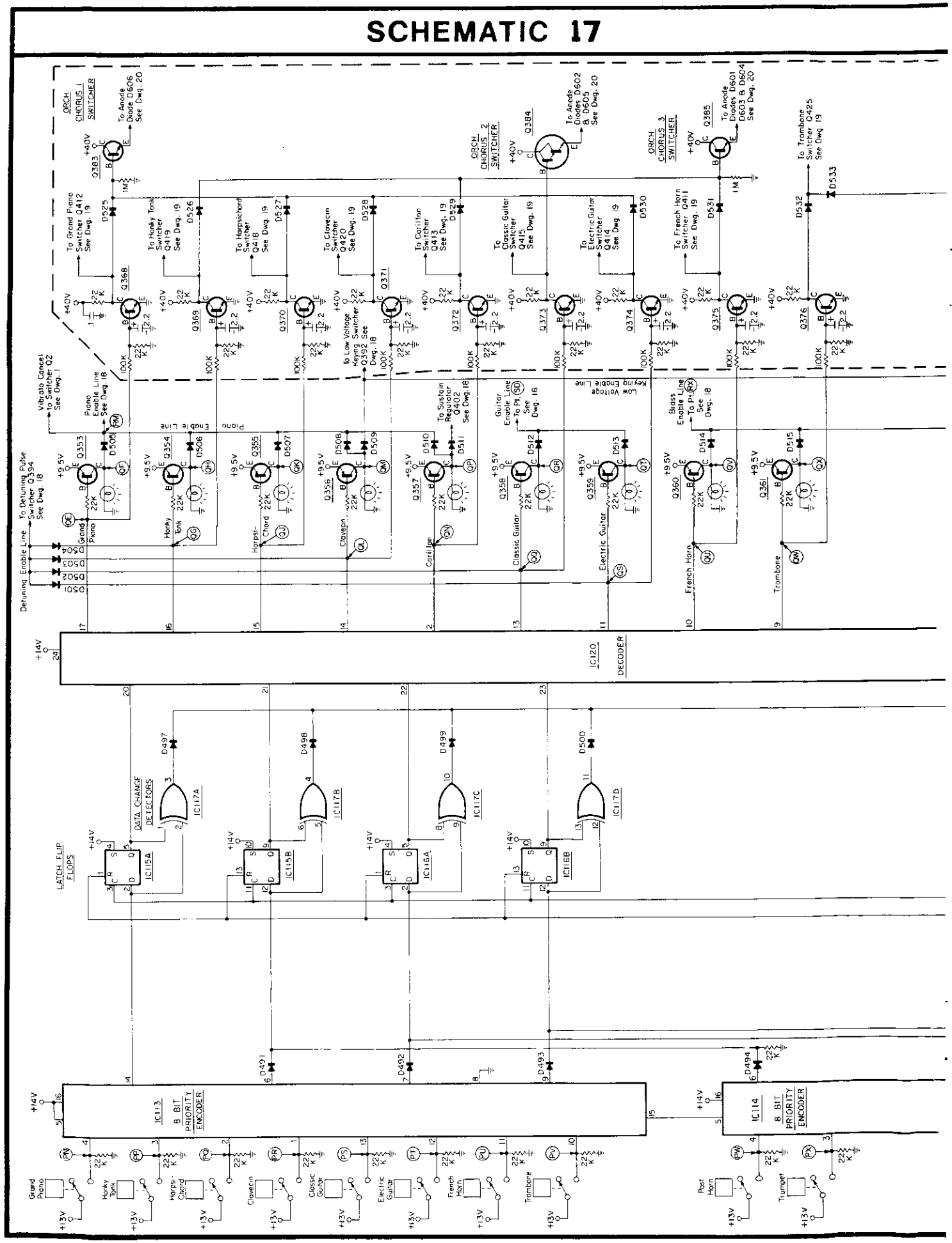
SCHEMATIC 16



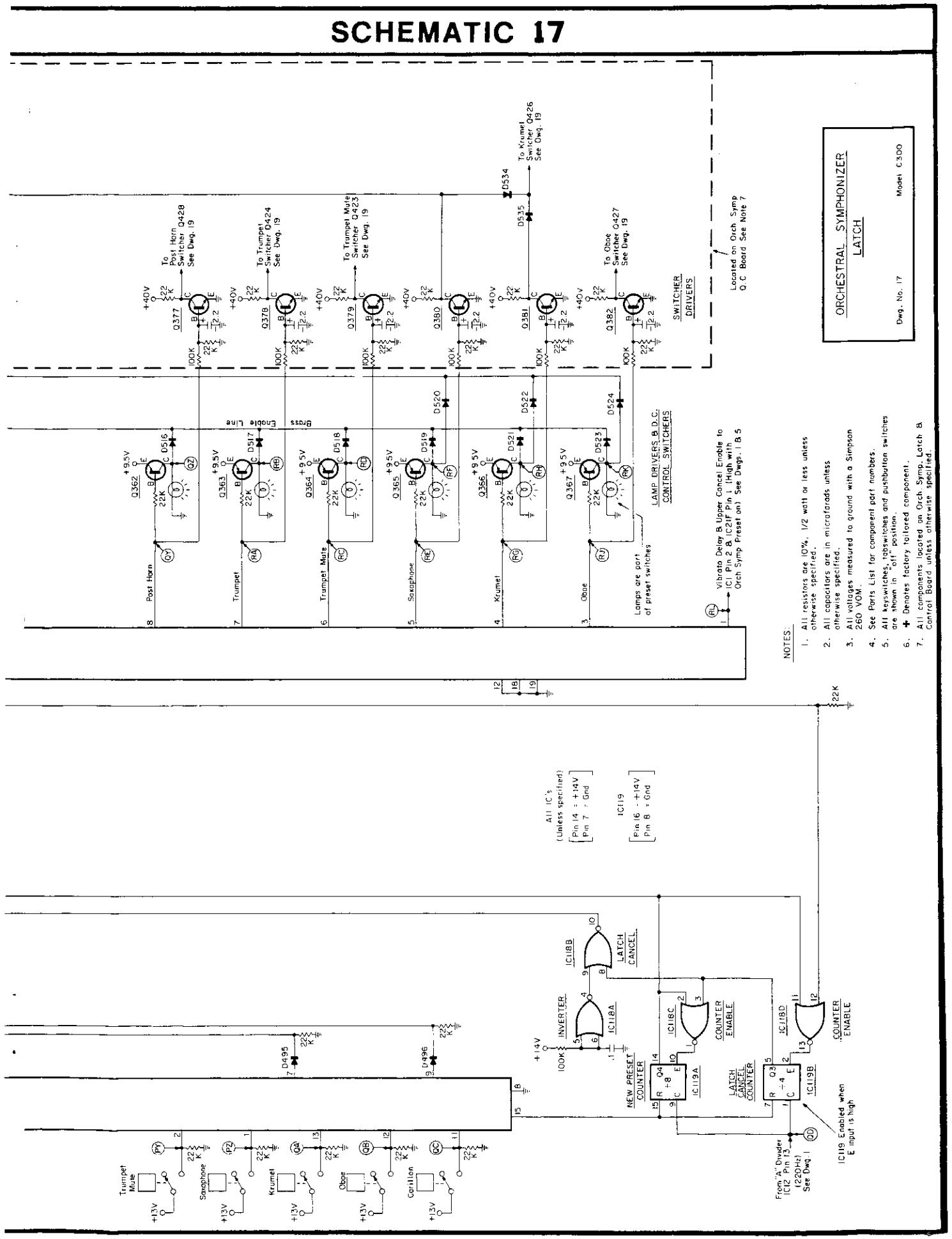
SCHEMATIC 16


BASS DRUM GENERATOR
TOM-TOM GENERATOR
BONGO GENERATOR
BLOCK GENERATOR
CLAVE GENERATOR
LOW DRUM GENERATOR
HIGH DRUM GENERATOR
Snare Cancel
SNARE KEYER
SNARE VOICING
NOISE GENERATOR
BRUSH KEYER
BRUSH VOICING
CYMBAL KEYER
CYMBAL VOICING
NOISE KEYER
NOISE VOICING
From Brush Length Regulator Q305 Pt. MA See Dwg. 15
From Cymbal Length Regulator Q308 Pt. MC See Dwg. 15
Located At Tab Panel
Rhythm Balance Control VR46
Rhythm Volume Control VR47
RHYTHM PREAMP
To Main Volume Regulator IC162 Pt. TW See Dwg. 23
IC106
Pin 14 = +15V
Pin 7 = GND
ALL OP-AMPS
Pin 11 = +15V
Pin 7 = -12V
NOTES
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component
7. All components located on Rhythm Instrumentation Board unless otherwise specified.
MANUAL RHYTHM, INSTRUMENTATION
Dwg. No. 16
C300

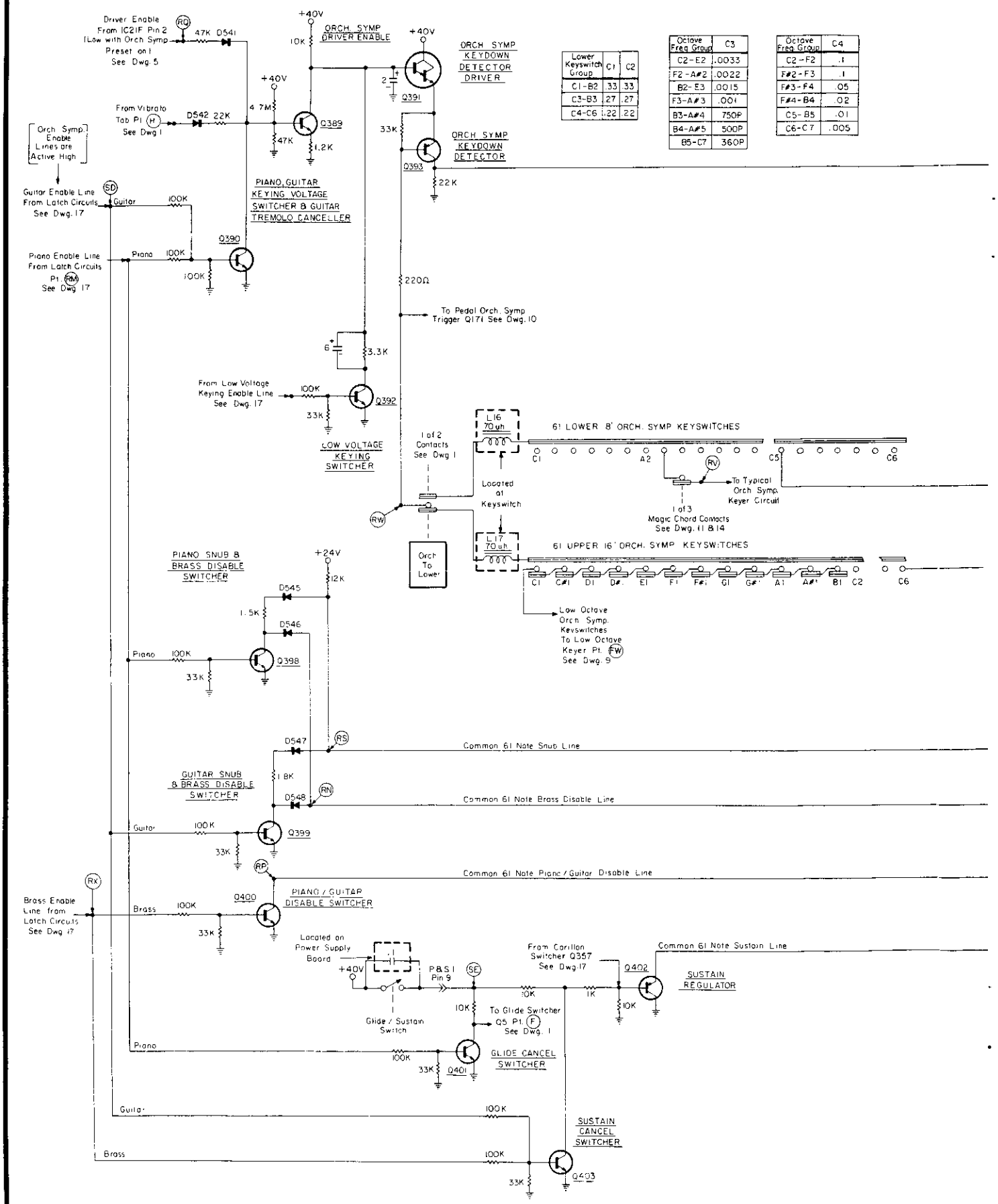
SCHEMATIC 17


ORCH CHORUS 1 SWITCHER
ORCH CHORUS 2 SWITCHER
ORCH CHORUS 3 SWITCHER
To Grand Piano Switcher Q412 See Dwg. 19
To Honky Tonk Switcher Q419 See Dwg. 19
To Harpsichord Switcher Q418 See Dwg. 19
To Clavecin Switcher Q417 See Dwg. 19
To Carillon Switcher Q413 See Dwg. 19
To Classic Guitar Switcher Q415 See Dwg. 19
To Electric Guitar Switcher Q416 See Dwg. 19
To French Horn Switcher Q411 See Dwg. 19
To Trombone Switcher Q425 See Dwg. 19
To Anode Diode D606 See Dwg. 20
To Anode Diodes D602 & D605 See Dwg. 20
To Anode Diodes D601 D603 & D604 See Dwg. 20
Vibrato Cancel To Switcher Q2 See Dwg. 1
Piano Enable Line See Dwg. 18
To Sustain Regulator Q402 See Dwg. 18
Guitar Enable Line To Pt See Dwg. 18
Brass Enable Line To Pt See Dwg. 18
Keying Enable Line
Low Voltage Keying Switch Q102 See Dwg. 18
To Detuning Pulse Switcher Q394 See Dwg. 18
Detuning Enable Line
Grand Piano
Honky Tonk
Harpsi-Chord
Clavecin
Carillon
Classic Guitar
Electric Guitar
French Horn
Trombone
IC120 DECODER
DATA CHANGE DETECTORS
IC117A
IC117B
IC117C
IC117D
LATCH FLIP FLOPS
IC115A
IC115B
IC116A
IC116B
IC113 8 BIT PRIORITY ENCODER
IC114 8 BIT PRIORITY ENCODER
Post Horn
Trumpet

SCHEMATIC 17



SCHEMATIC 18

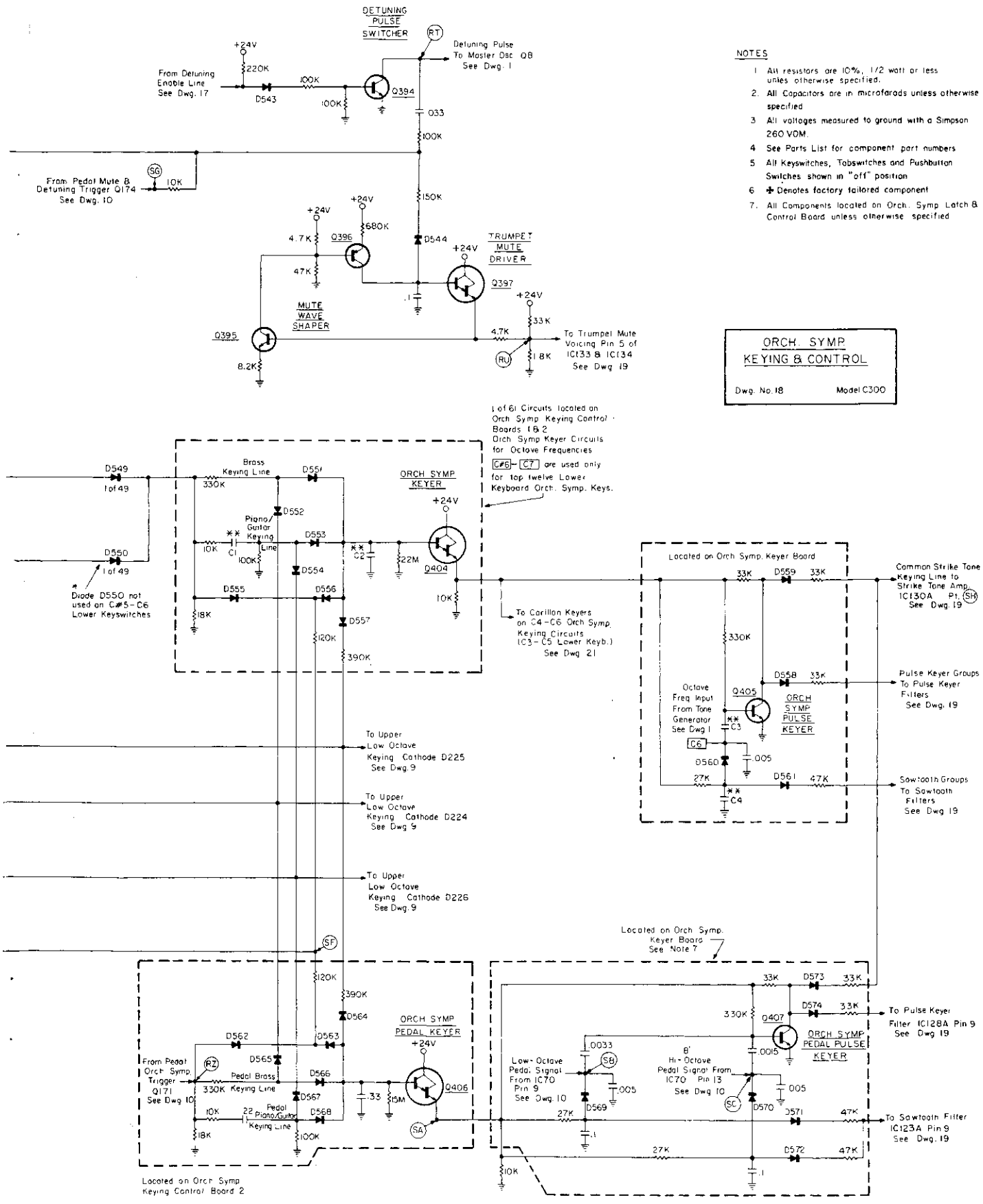


Lower Keyswitch Group	C1	C2
C1-B2	33	33
C3-B3	27	27
C4-C6	22	22

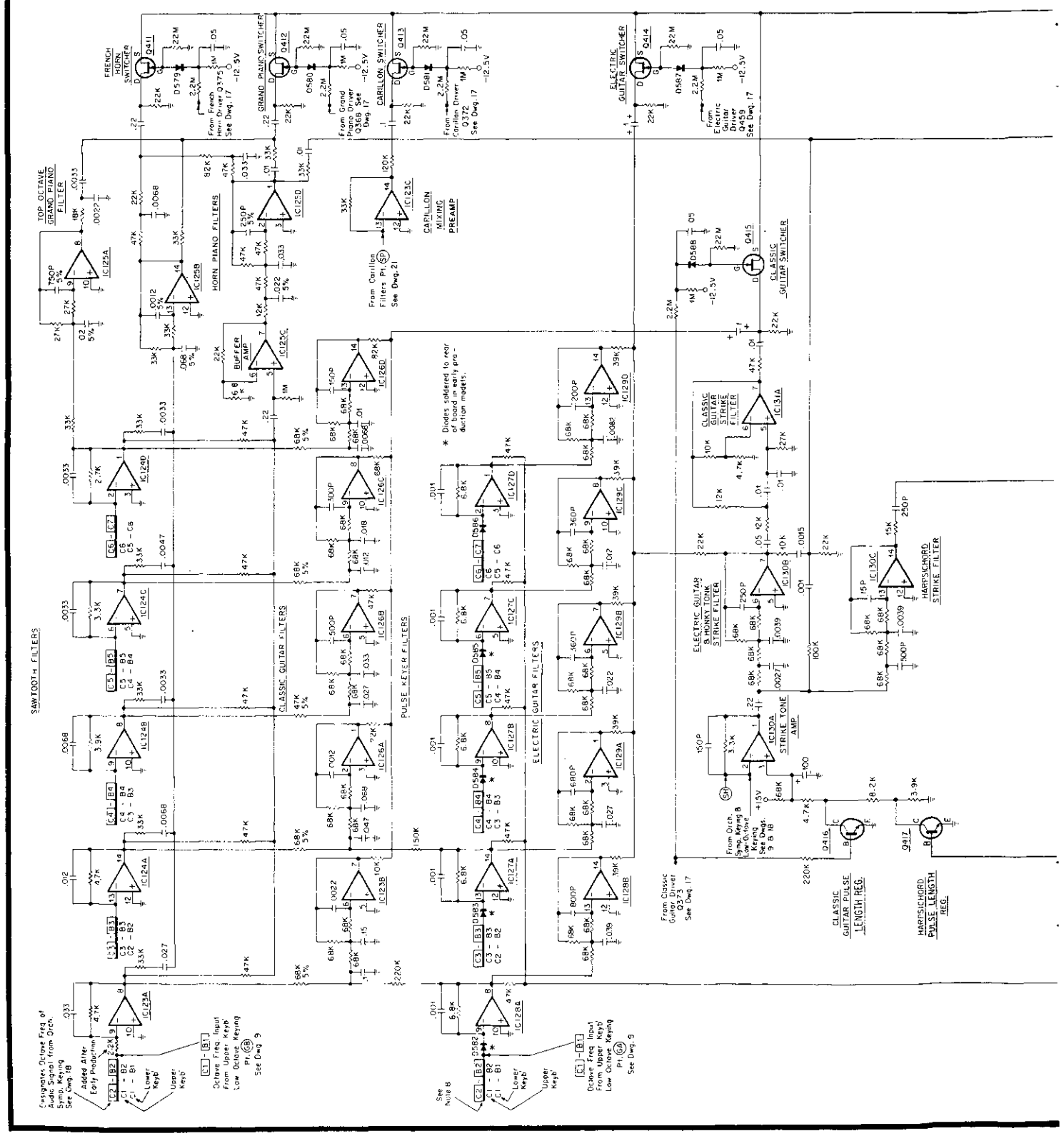
Octave Freq Group	C3
C2-E2	.0033
F2-A#2	.0022
B2-E3	.0015
F3-A#3	.001
B3-A#4	750P
B4-A#5	500P
B5-C7	360P

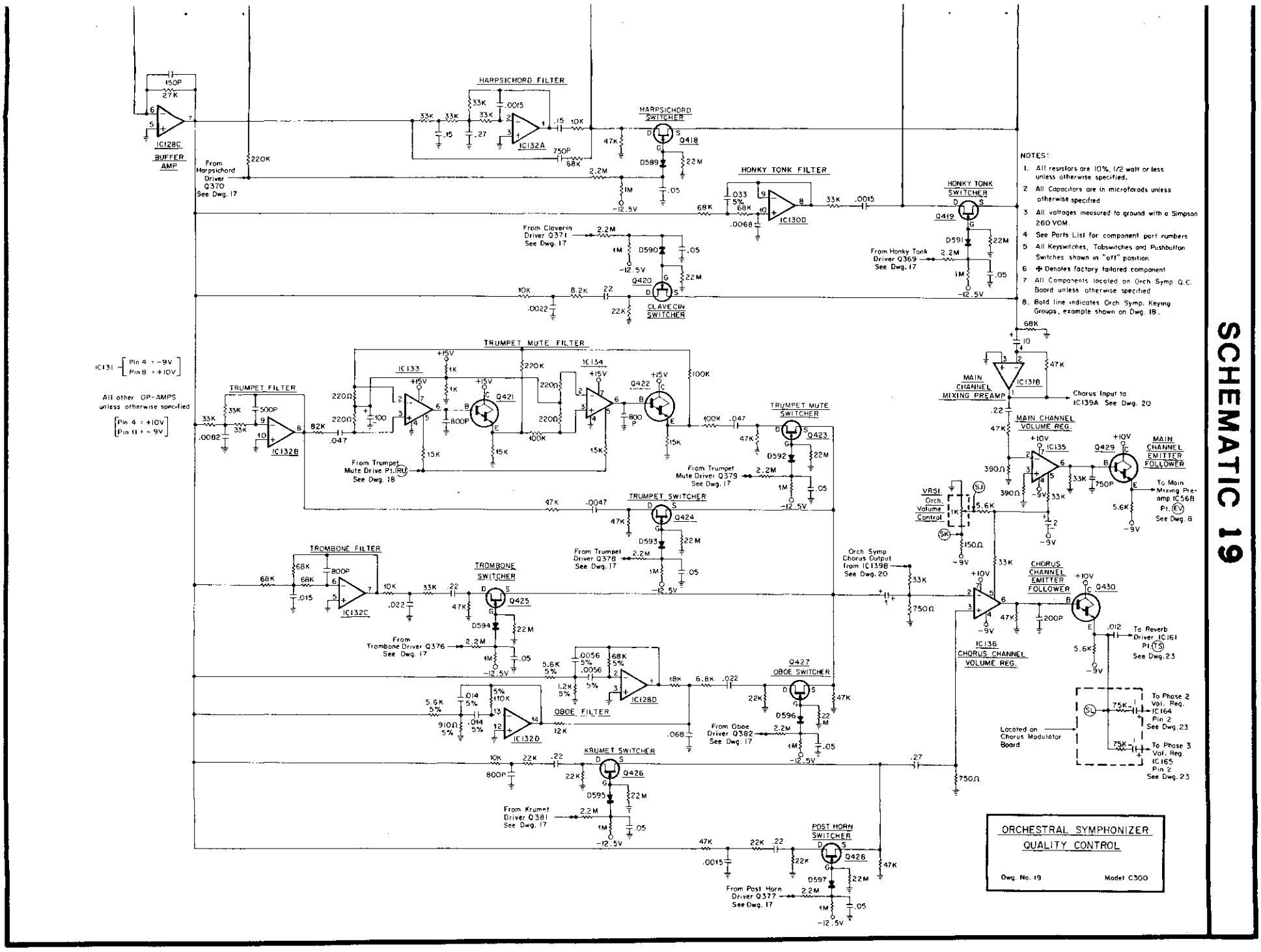
Octave Freq Group	C4
C2-F2	.1
F#2-F3	.1
F#3-F4	.05
F#4-B4	.02
C5-B5	.01
C6-C7	.005

SCHEMATIC 18



SCHEMATIC 19



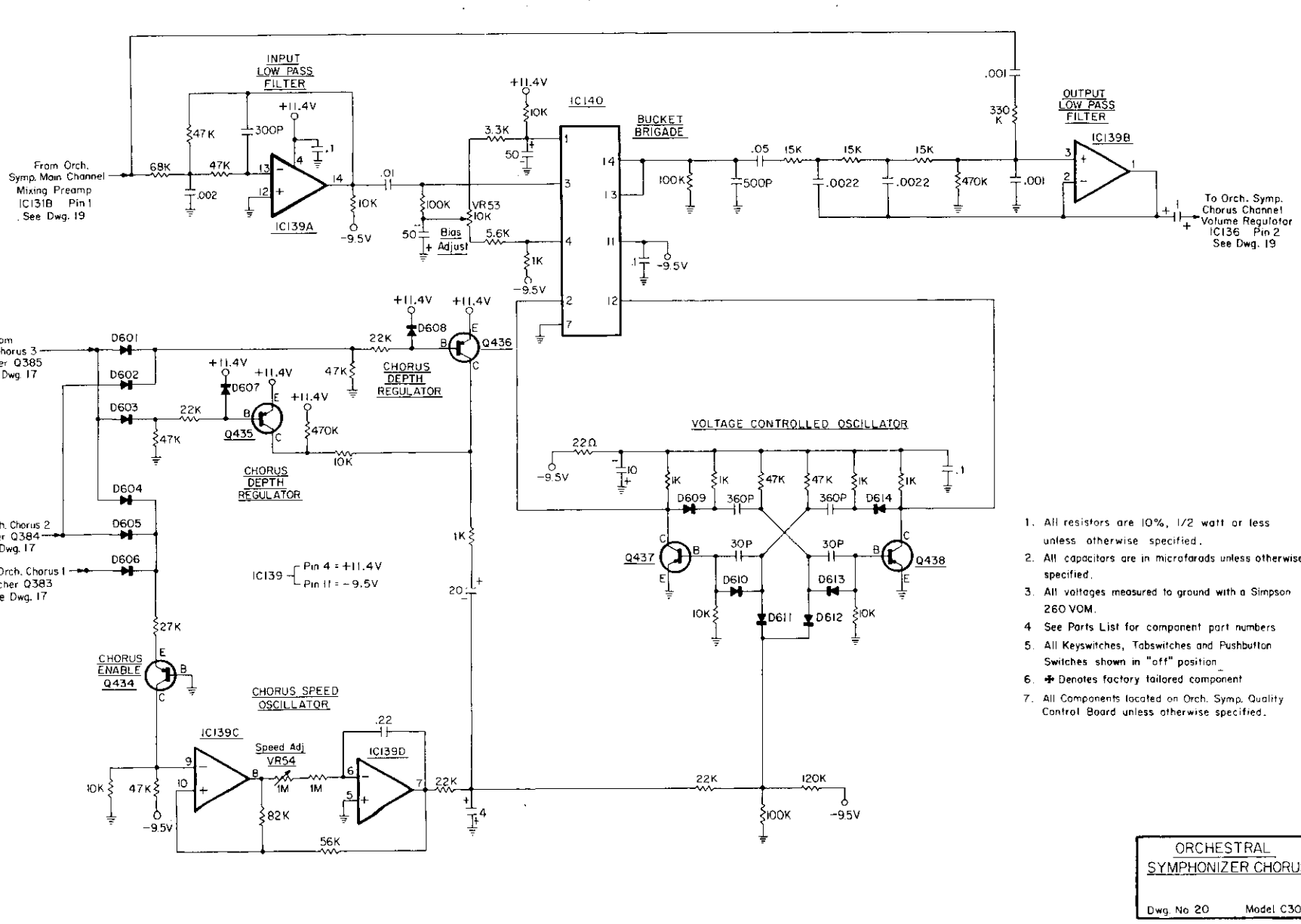


NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. ✠ Denotes factory tailored component
7. All Components located on Orch Symp Q.C. Board unless otherwise specified
8. Bold line indicates Orch Symp. Keying Groups, example shown on Dwg. 18.

ORCHESTRAL SYMPHONIZER
QUALITY CONTROL

Dwg. No. 19 Model C300



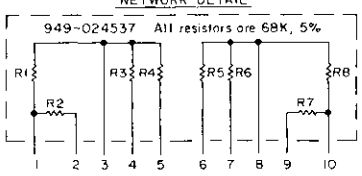
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. ✠ Denotes factory tailored component
7. All Components located on Orch. Symp. Quality Control Board unless otherwise specified.

ORCHESTRAL SYMPHONIZER CHORUS

Dwg. No 20 Model C300

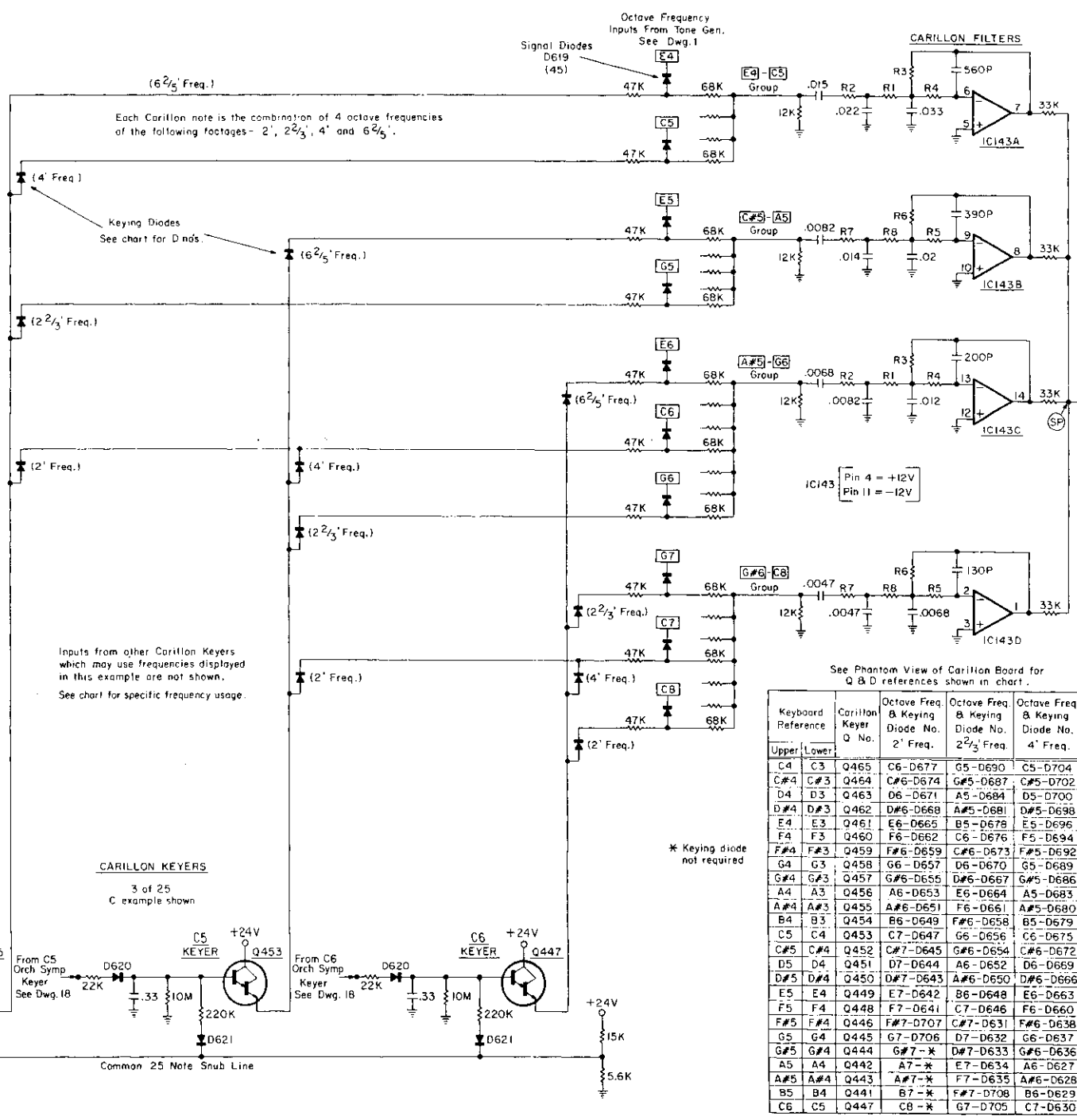
NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages are measured to ground with a Simpson 260 V O M.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches are shown in "off" position.
6. ✠ Denotes factory tailored component.
7. All resistors with "R" nos. are contained in network.
8. All components located on Carillon Board unless otherwise specified.



CARILLON KEYING & FILTERING

Dwg. No. 21 Model C300

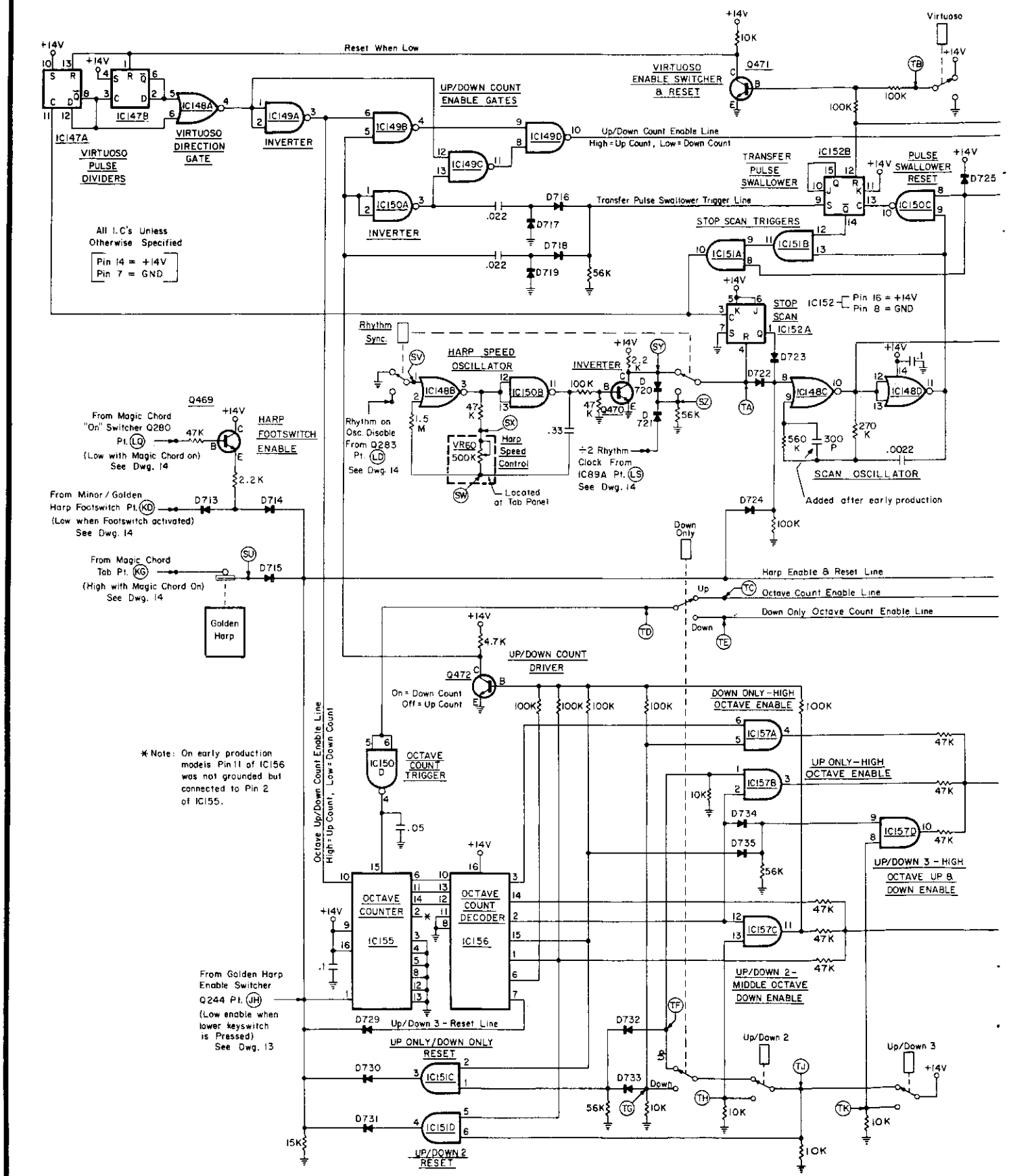


* Keying diode not required

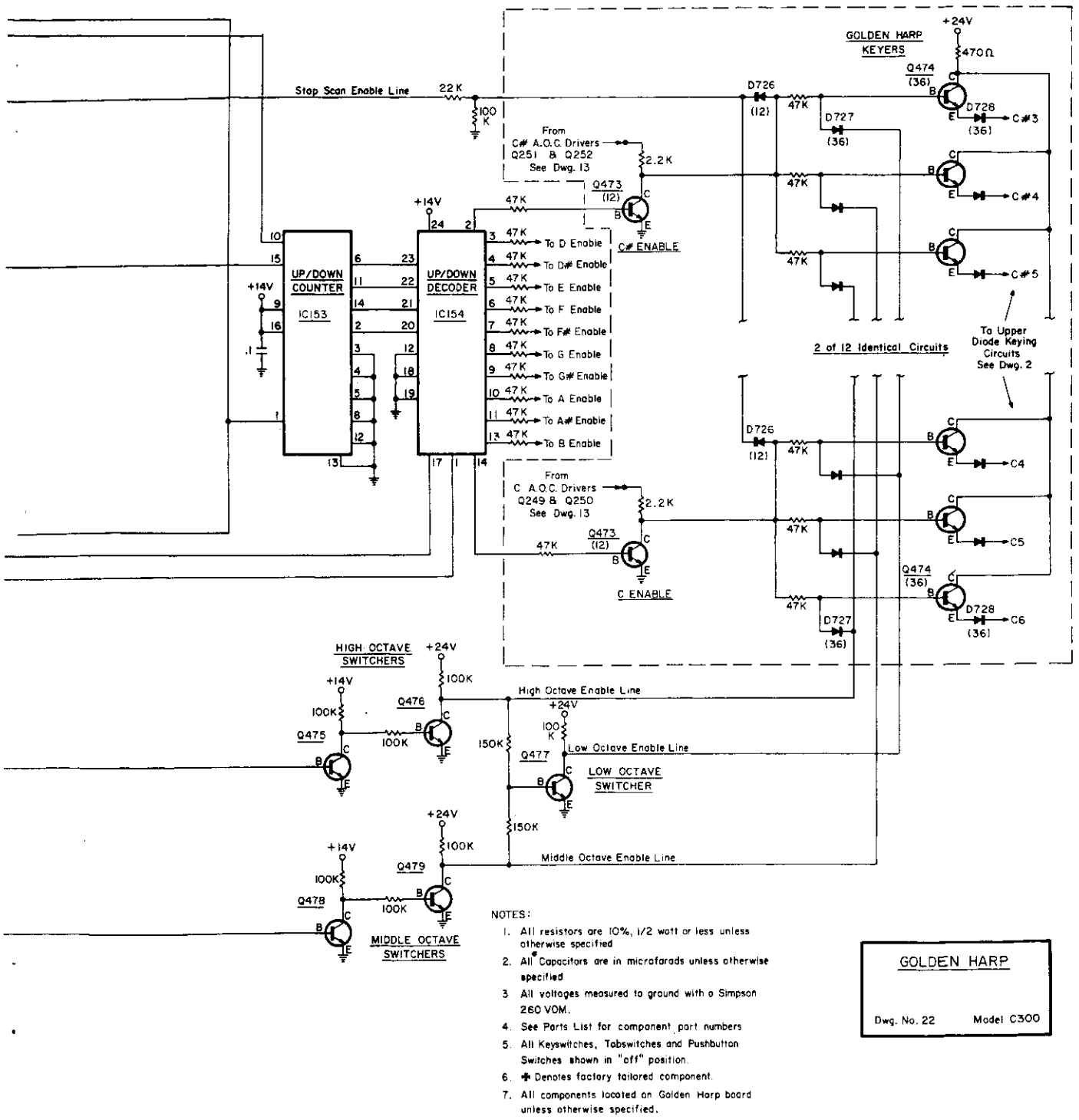
See Phantom View of Carillon Board for Q & D references shown in chart.

Keyboard Reference		Carillon Keyer Q No.	Octave Freq. & Keying Diode No. 2' Freq.	Octave Freq. & Keying Diode No. 2 2/3' Freq.	Octave Freq. & Keying Diode No. 4' Freq.	Octave Freq. & Keying Diode No. 6 2/5' Freq.
Upper	Lower					
C4	C3	Q465	C6-D677	G5-D690	C5-D704	E4-✠
C#4	C#3	Q464	C#6-D674	G#5-D687	C#5-D702	F4-✠
D4	D3	Q463	D6-D671	A5-D684	D5-D700	F#4-✠
D#4	D#3	Q462	D#6-D668	A#5-D681	D#5-D698	G4-✠
E4	E3	Q461	E6-D665	B5-D678	E5-D696	G#4-✠
F4	F3	Q460	F6-D662	C6-D676	F5-D694	A4-✠
F#4	F#3	Q459	F#6-D659	C#6-D673	F#5-D692	A#4-✠
G4	G3	Q458	G6-D657	D6-D670	G5-D689	B4-✠
G#4	G#3	Q457	G#6-D655	D#6-D667	G#5-D686	C5-D703
A4	A3	Q456	A6-D653	E6-D664	A5-D683	C#5-D701
A#4	A#3	Q455	A#6-D651	F6-D661	A#5-D680	D5-D699
B4	B3	Q454	B6-D649	F#6-D658	B5-D679	D#5-D697
C5	C4	Q453	C7-D647	G6-D656	C6-D675	E5-D695
C#5	C#4	Q452	C#7-D645	G#6-D654	C#6-D672	F5-D693
D5	D4	Q451	D7-D644	A6-D652	D6-D669	F#5-D691
D#5	D#4	Q450	D#7-D643	A#6-D650	D#6-D666	G5-D688
E5	E4	Q449	E7-D642	B6-D648	E6-D663	G#5-D685
F5	F4	Q448	F7-D641	C7-D646	F6-D660	A5-D682
F#5	F#4	Q446	F#7-D707	C#7-D631	F#6-D638	A#5-D624
G5	G4	Q445	G7-D706	D7-D632	G6-D637	B5-D623
G#5	G#4	Q444	G#7-✠	D#7-D633	G#6-D636	C6-D622
A5	A4	Q442	A7-✠	E7-D634	A6-D627	C#6-D626
A#5	A#4	Q443	A#7-✠	F7-D635	A#6-D628	D6-D625
B5	B4	Q441	B7-✠	F#7-D708	B6-D629	D#6-D640
C6	C5	Q447	C8-✠	G7-D705	C7-D630	E6-D639

SCHEMATIC 22



SCHEMATIC 22



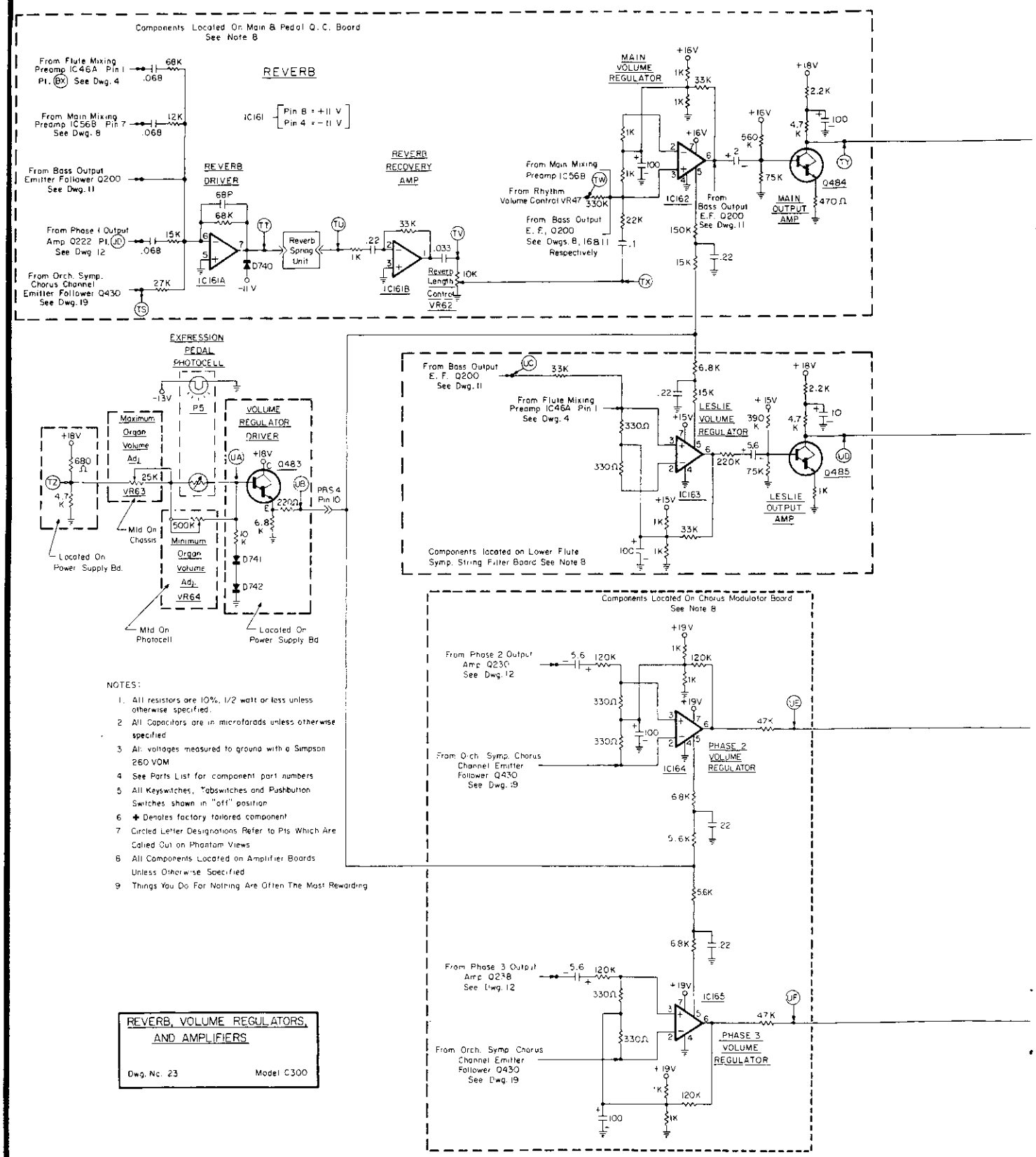
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Golden Harp board unless otherwise specified.

GOLDEN HARP

Dwg. No. 22 Model C300

SCHEMATIC 23


Components Located On Main & Pedal Q. C. Board See Note 8
REVERB
IC161 Pin 8 = +11 V Pin 4 = −11 V
From Flute Mixing Preamp IC46A Pin 1 Pt. (BX) See Dwg. 4
From Main Mixing Preamp IC56B Pin 7 See Dwg. 8
From Bass Output Emitter Follower Q200 See Dwg. 11
From Phase 1 Output Amp Q222 Pt. (JD) See Dwg 12
From Orch. Symp. Chorus Channel Emitter Follower Q430 See Dwg. 19
REVERB DRIVER
IC161A
IC161B
D740
Reverb Spring Unit
REVERB RECOVERY AMP
Reverb Length Control VR62
MAIN VOLUME REGULATOR
From Main Mixing Preamp IC56B
From Rhythm Volume Control VR47
IC162
From Bass Output E.F. Q200 See Dwg. 11
From Bass Output E. F. Q200 See Dwgs. 8, 16&11 Respectively
MAIN OUTPUT AMP
Q484
EXPRESSION PEDAL PHOTOCELL
VOLUME REGULATOR DRIVER
Maximum Organ Volume Adj. VR63
Minimum Organ Volume Adj. VR64
Mtd On Chassis
Mtd On Photocell
Located On Power Supply Bd.
Located On Power Supply Bd
Q483
D741
D742
PRS 4 Pin 10
From Bass Output E. F. Q200 See Dwg. 11
From Flute Mixing Preamp IC46A Pin 1 See Dwg. 4
LESLIE VOLUME REGULATOR
IC163
LESLIE OUTPUT AMP
Q485
Components located on Lower Flute Symp. String Filter Board See Note 8
Components Located On Chorus Modulator Board See Note 8
From Phase 2 Output Amp Q230 See Dwg. 12
From O-ch. Symp. Chorus Channel Emitter Follower Q430 See Dwg. 19
IC164
PHASE 2 VOLUME REGULATOR
From Phase 3 Output Amp Q238 See Dwg. 12
From Orch. Symp Chorus Channel Emitter Follower Q430 See Dwg. 19
IC165
PHASE 3 VOLUME REGULATOR

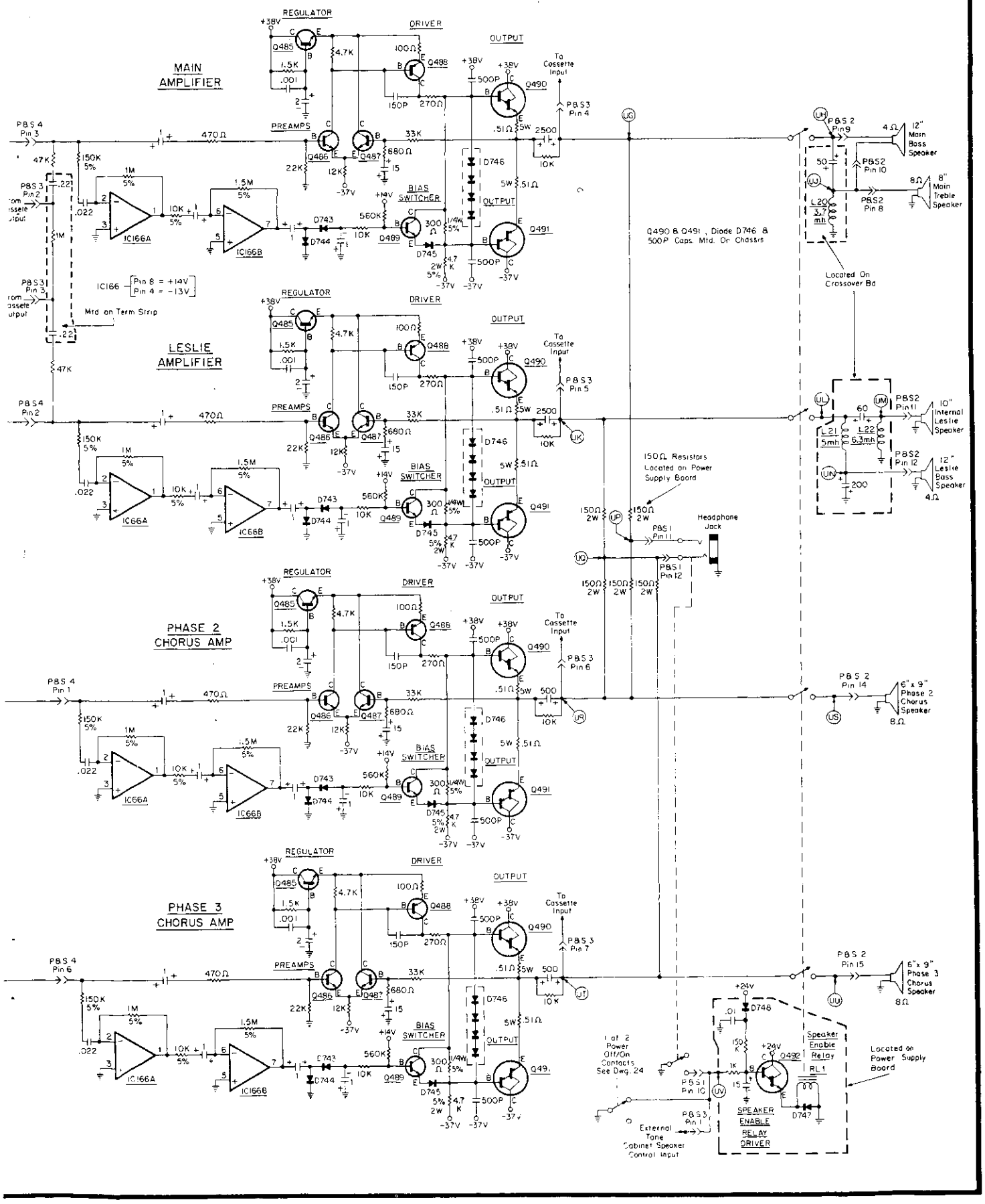
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM
4. See Parts List for component part numbers
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position
6. ✚ Denotes factory tailored component
7. Circled Letter Designations Refer to Pts Which Are Called Out on Phantom Views
8. All Components Located on Amplifier Boards Unless Otherwise Specified
9. Things You Do For Nothing Are Often The Most Rewarding

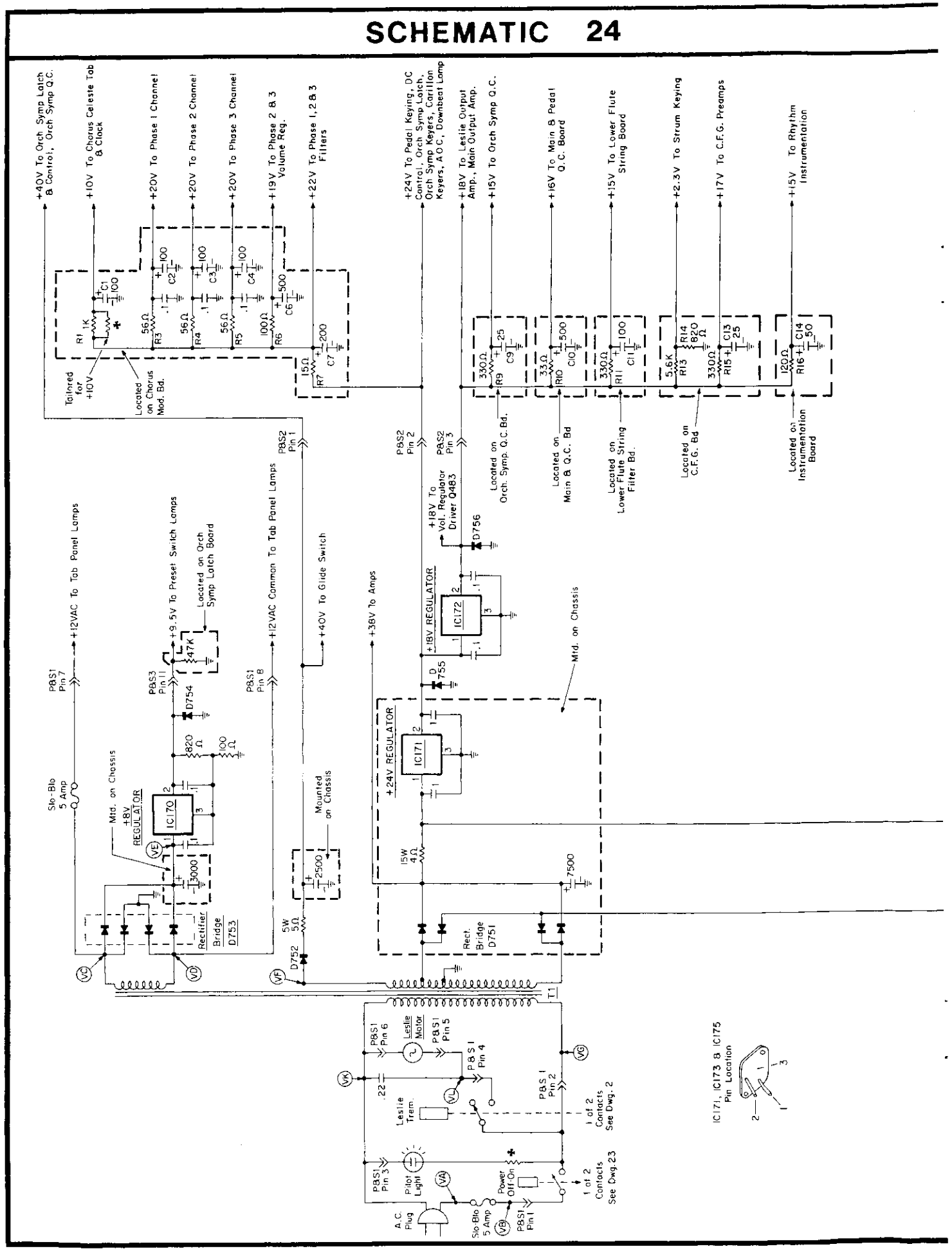
REVERB, VOLUME REGULATORS, AND AMPLIFIERS

Dwg. No. 23 Model C300

SCHEMATIC 23


MAIN AMPLIFIER
LESLIE AMPLIFIER
PHASE 2 CHORUS AMP
PHASE 3 CHORUS AMP
REGULATOR
DRIVER
OUTPUT
PREAMPS
BIAS SWITCHER
IC166A
IC166B
IC166 Pin 8 = +14V Pin 4 = -13V
Mtd on Term Strip
To Cassette Input
Q490 & Q491, Diode D746 & 500P Caps. Mtd. On Chassis
Located On Crossover Bd
150Ω Resistors Located on Power Supply Board
Headphone Jack
12" Main Bass Speaker
8" Main Treble Speaker
10" Internal Leslie Speaker
12" Leslie Bass Speaker
6"x 9" Phase 2 Chorus Speaker
6"x 9" Phase 3 Chorus Speaker
1 of 2 Power Off/On Contacts See Dwg. 24
SPEAKER ENABLE RELAY DRIVER
Speaker Enable Relay
Located on Power Supply Board
External Tone Cabinet Speaker Control Input

SCHEMATIC 24

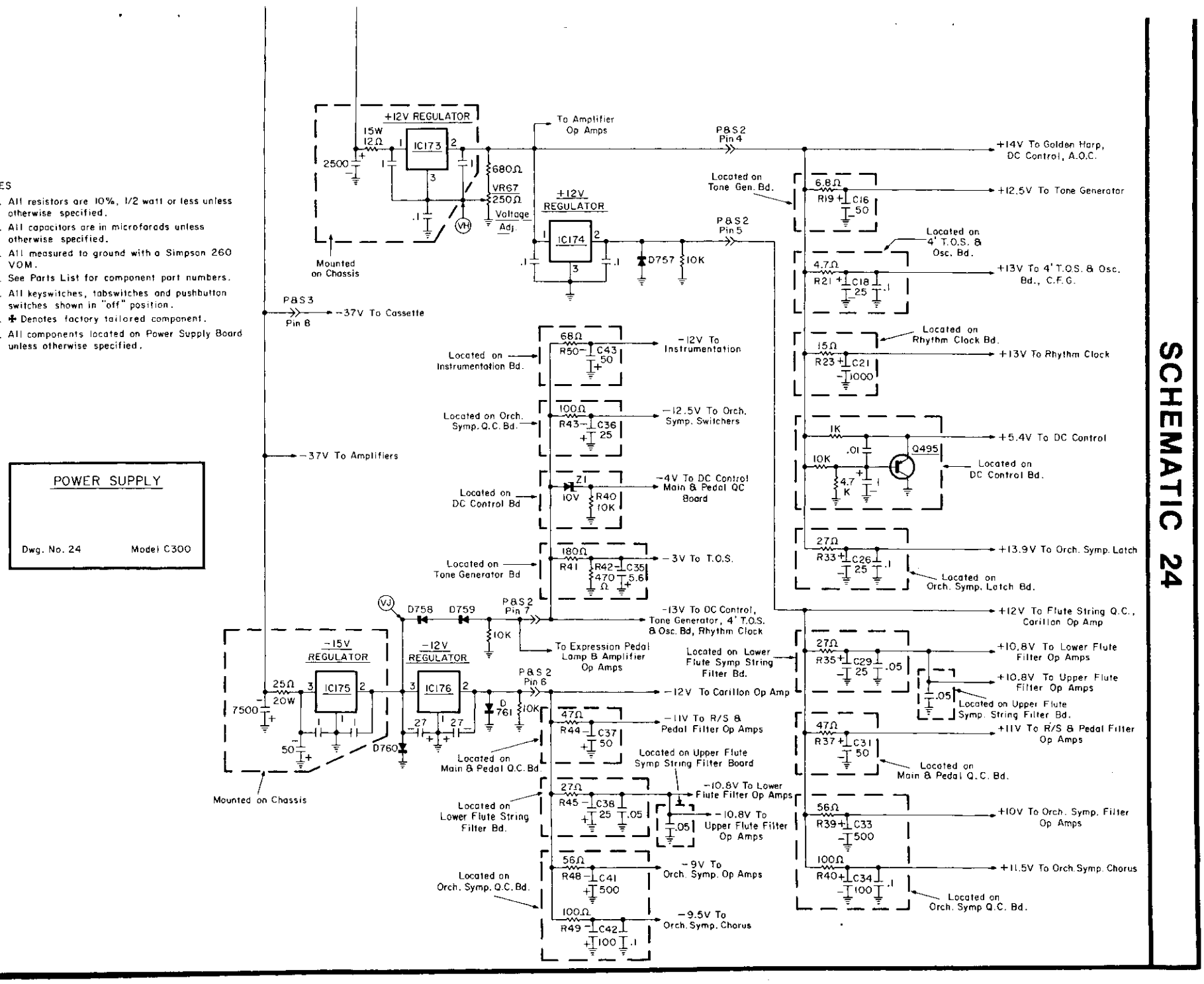

+40V To Orch Symp Latch & Control, Orch Symp Q.C.
+10V To Chorus Celeste Tab & Clock
+20V To Phase 1 Channel
+20V To Phase 2 Channel
+20V To Phase 3 Channel
+19V To Phase 2 & 3 Volume Reg.
+22V To Phase 1, 2 & 3 Filters
+24V To Pedal Keying, DC Control, Orch Symp Latch, Orch Symp Keyers, Carillon Keyers, A.O.C., Downbeat Lamp
+18V To Leslie Output Amp., Main Output Amp.
+15V To Orch Symp Q.C.
+16V To Main & Pedal Q.C. Board
+15V To Lower Flute String Board
+2.3V To Strum Keying
+17V To C.F.G. Preamps
+15V To Rhythm Instrumentation
Tailored for +10V
Located on Chorus Mod. Bd.
Located on Orch. Symp. Q.C. Bd.
Located on Main & Q.C. Bd
Located on Lower Flute String Filter Bd.
Located on C.F.G. Bd
Located on Instrumentation Board
+12VAC To Tab Panel Lamps
+9.5V To Preset Switch Lamps
Located on Orch Symp Latch Board
+12VAC Common To Tab Panel Lamps
+40V To Glide Switch
+36V To Amps
+18V To Vol. Regulator Driver Q483
+18V REGULATOR
IC172
Mtd. on Chassis
+8V REGULATOR
IC170
+24V REGULATOR
IC171
Slo-Blo 5 Amp
Rectifier Bridge D753
Mounted on Chassis
Rect. Bridge D751
D752
Leslie Motor
Leslie Trem.
Pilot Light
Power Off-On
A.C. Plug
1 of 2 Contacts See Dwg. 2
1 of 2 Contacts See Dwg. 23
IC171, IC173 & IC175 Pin Location

NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✣ Denotes factory tailored component.
7. All components located on Power Supply Board unless otherwise specified.

POWER SUPPLY

Dwg. No. 24 Model C300

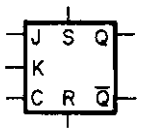


TRUTH TABLES

	LOWREY PART NO	MFG PART NO.	MFG	FIG
	994-025225	(MM)74C74	NATIONAL	2
	994-026005	(MM)74C86	NATIONAL	43
	994-025536	(MM)74C02	NATIONAL	42
	994-025546	(CDJ4074	RCA	44
	994-025547	(CD)4084	RCA	9
	994-025545	(CD)4044	RCA	40
	994-024593	(MM)74C00	NATIONAL	40
	994-026006	(MO44520	MOTOROLA	3
	99 4-026025	(CD)4004	RCA	42
	994-026022	(CD)4027	RCA	4
	994-026023	(CD)4028	RCA	7
	994-024595	(MM)74C454	NATIONAL	44
	994-025599	(MC)44532	MOTOROLA	8
*	994-026646	(CD)4544	RCA	4
*	994-026605	(CD) 4023	RCA	6
*	994-026606	(CD) 4075	RCA	5
*	994-026604	(MC)74C08	NATIONAL	9

These parts not used in C300.

FIG. 1

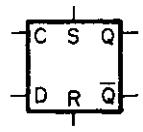


J-K FLIP-FLOP

					T_n+4	
J	K	S	R	Clk	Q	Q
4	0	0	0	⨍	4	0
0	4	0	0	⨍	0	4
0	0	0	0	⨍	Qn	Qn
4	4	0	0	⨍	Qn	Qn
X	X	0	4	X	0	4
X	X	4	0	X	4	0
X	X	4	4	X	4	4

X= Don't Care

FIG. 2



D FLIP-FLOP

T_n				TrfH
D	S	R	Clk	Q
1	1	1	⨍	4
0	1	1	⨍	0
X	0	1	X	4
X	1	0	X	0
–	0	0	–	NOT DEF.

X= Don t Care

FIG. 3

CLOCK	ENABLE	RESET	ACTION
⨍	1	0	Counter
0	⨍	0	Counter
⨍	0	0	No Change
1	⨍	0	No Change
X	X	1	Q4-Q4 = 0

X = Dont Care

FIG. 4

Pin Nos.	INH.	INPUT				OUTPUT															
	23	22	24	3	2	44	9	40	8	7	6	5	4	48	47	20	49	44	43	46	45
	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	4	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
	0	0	4	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
	0	0	4	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
	0	0	4	4	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
	0	4	0	0	4	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
	0	4	0	4	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
	0	4	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
	0	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	4	X	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

X= Don t Core

FIG. 5

TRIPLE-INPUT OR

A	B	C	D
0	0	0	0
0	0	4	4
0	4	o.	4
0	4	4	4
4	0	0	4
4	0	4	4
4	4	0	4
4	4	4	4

FIG. 6

TRIPLE-INPUT NAND

A	B	C	D
0	0	0	4
0	0	4	4
0	4	0	4
0	4	4	4
4	0	0	4
4	0	4	4
4	4	0	4
4	4	4	0

TRUTH TABLES

FIG. 7

Pin Nos.-"*	INPUT				OUTPUT									
	44	42	43	40	3	14	2	45	4	6	7	4 | 9		5
	0	0	0	0	4	0	0	0	0	0	0	0	0	0
	0	0	0	4	0	4	0	0	0	0	0	0	0	0
	0	0	4	0	0	0	4	0	0	0	0	0	0	0
	0	0	4	4	0	0	0	4	0	0	0	0	0	0
	0	4	0	0	0	0	0	0	4	0	0	0	0	0
	0	4	0	4	0	0	0	0	0	4	0	0	0	0
	0	4	4	0	0	0	0	0	0	0	4	0	0	0
	0	4	4	4	0	0	0	0	0	0	0	4	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	4	0
	4	0	0	4	0	0	0	0	0	0	0	0	0	4

FIG. 8

Pin Nos.-H	INPUT									OUTPUT				
	5	4	3	2	4	43	42	44	40	44	6	7	9	45
	0	X	X	X	X	X	X	X	X	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	4
	4	4	X	X	X	X	X	X	X	1	4	4	4	0
	4	0	4	X	X	X	X	X	X	4	4	4	0	0
	4	0	0	4	X	X	X	X	X	4	4	0	4	0
	4	0	0	0	4	X	X	X	X	4	4	0	0	0
	4	0	0	0	0	4	X	X	X	4	0	4	4	0
	1	0	0	0	0	0	4	X	X	1	0	4	0	0
	1	0	0	0	0	0	0	4	X	4	0	0	4	0
	4	0	0	0	0	0	0	0	4	4	0	0	0	0

X=Dont Care

FIG. 9

AND

A	B	C
0	0	0
0	4	0
4	0	0
4	4	4

FIG. 10

NAND

A	B	C
0	0	4
0	4	1
4	0	4
4	4	0

FIG. 11

OR

A	B	C
0	0	0
0	4	4
4	0	4
4	4	4

FIG. 12

NOR

A	B	C
0	0	4
0	4	0
4	0	0
4	4	0

FIG. 13

EXCLUSIVE OR

A	B	C
0	0	0
0	4	4
4	0	4
4	4	0

FIG. 44

Pin Nos.-	CONT.		INPUT				OUTPUT															
	48	49	20	24	22	23	1	2	3	4	5	6	7	8	9	40	41	43	44	45	46	47
	0	0	0	0	0	0	0	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	0	0	0	0	0	4	4	0	4	4	1	4	4	4	4	4	4	1	1	4	4	4
	0	0	0	0	4	0	4	1		4	4	4	4	4	1	4	4	4	4	4	4	4
	0	0	0	0	4	4	1	1	4		4	4	4	4	4	4	4	4	4	4	1	4
	0	0	0	4	0	0	1	4	4	4		4	4	4	4	4	4	4	4	4	1	4
	0	0	0	4	0	4	4	4	4	4	4		4	4	4	4	4	4	4	4	4	4
	0	0	0	4	4	0	1	4	4	4	4	4		4		4	4	4	4	4	1	4
	0	0	0	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	1	4
	0	0	4	0	0	0	4	1	4	4	4	4	4	4		4	4	4	4	4	4	4
	0	0	4	0	0	1	4	4	4	4	4	4	4	4	4	0	4	4	4	4	4	4
	0	0	4	0	4	0	4	1	4	4	4	4	4	1	4	4		4	4	4	4	4
	0	0	4	0	4	4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4
	0	0	1	4	0	0	4	4	4	4	4	4	4	1	1	1	4	4		4	4	4
	0	0	1	4	0	4	1	4	4	4	4	4	4	4	4	4	4	4	4		4	4
	0	0	4	4	4	0	4	1	4	4	4	4	4	4	4	4	4	4	4	1		1
	0	0	4	4	4	4	1	4	1	4	4	4	4	4	4	4	4	4	4	4	4	
	0	1	X	X	X	X	4	1	4	4	4	4	4	4	4	4	1	4	4	4	4	4
	4	0	X	X	X	X	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	4	4	X	X	X	X	4	1	4	4	4	4	4	4	4	1	4	4	4	<	4	<

X = Don t Care

TRANSISTOR BASING DIAGRAM

FIG. A

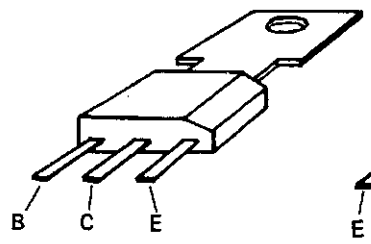


FIG. B

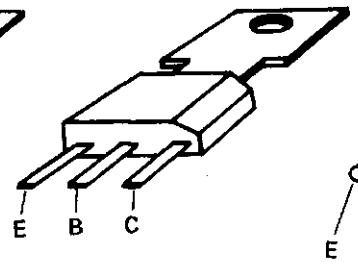


FIG. C

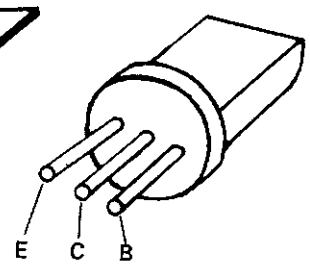


FIG. D

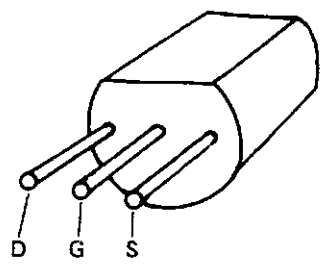


FIG. E

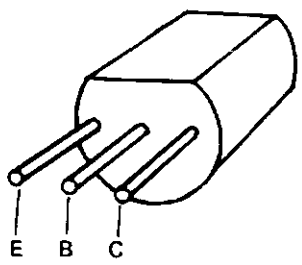


FIG. F

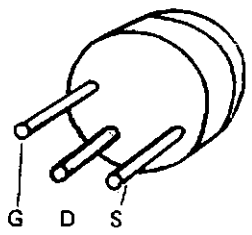


FIG. G

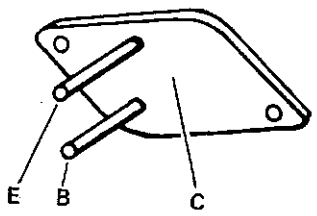


FIG.H

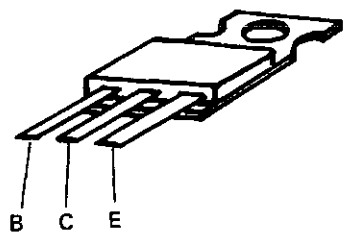


FIG.J

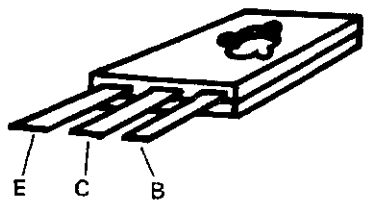


FIG. K

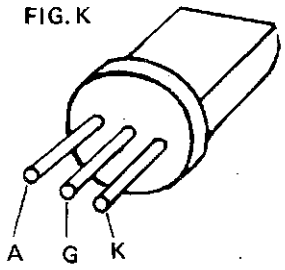


FIG. L

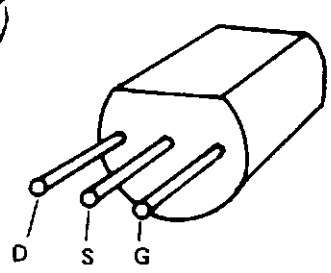
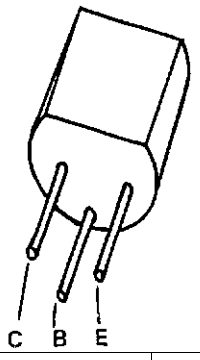
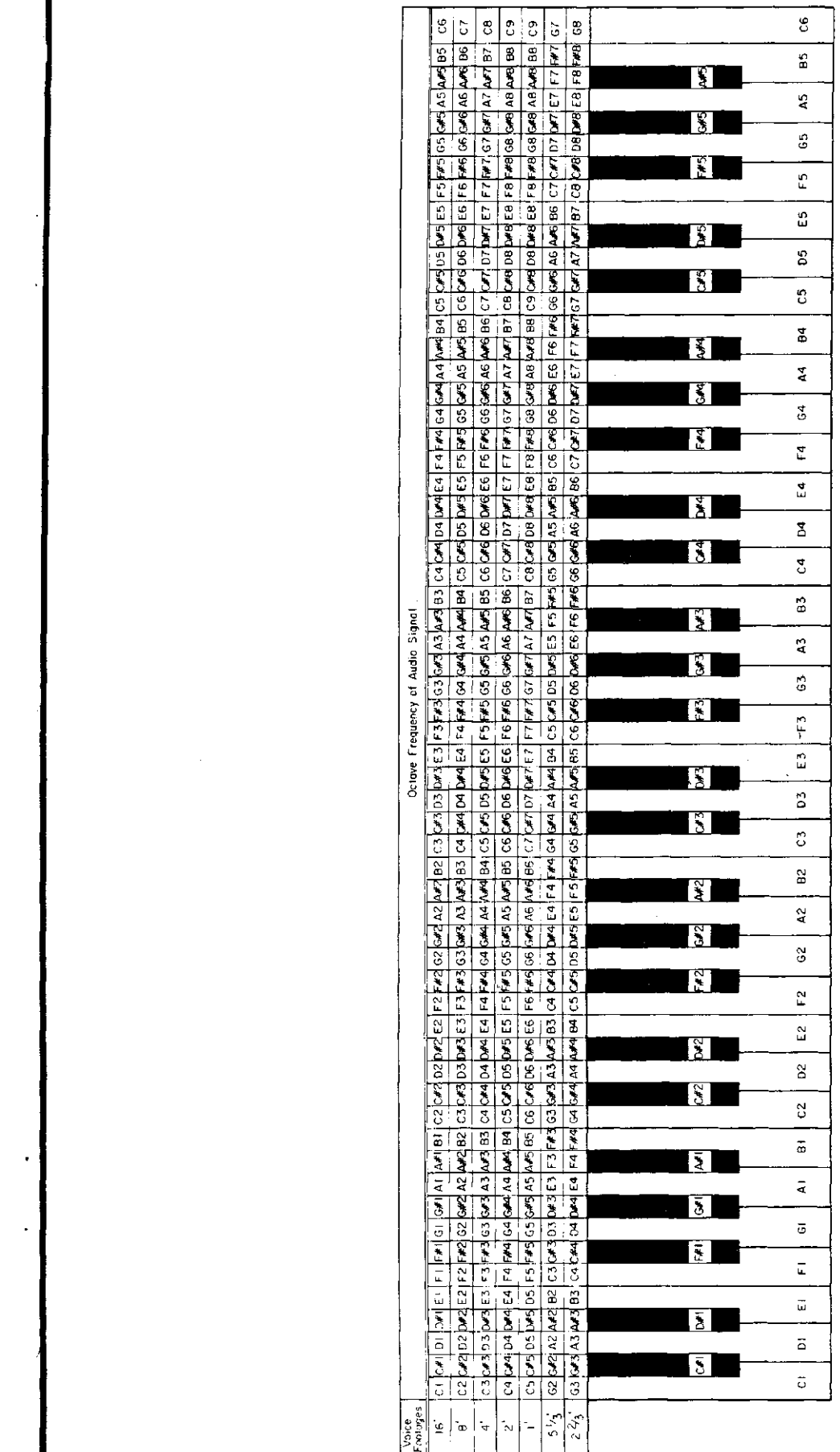


FIG. M

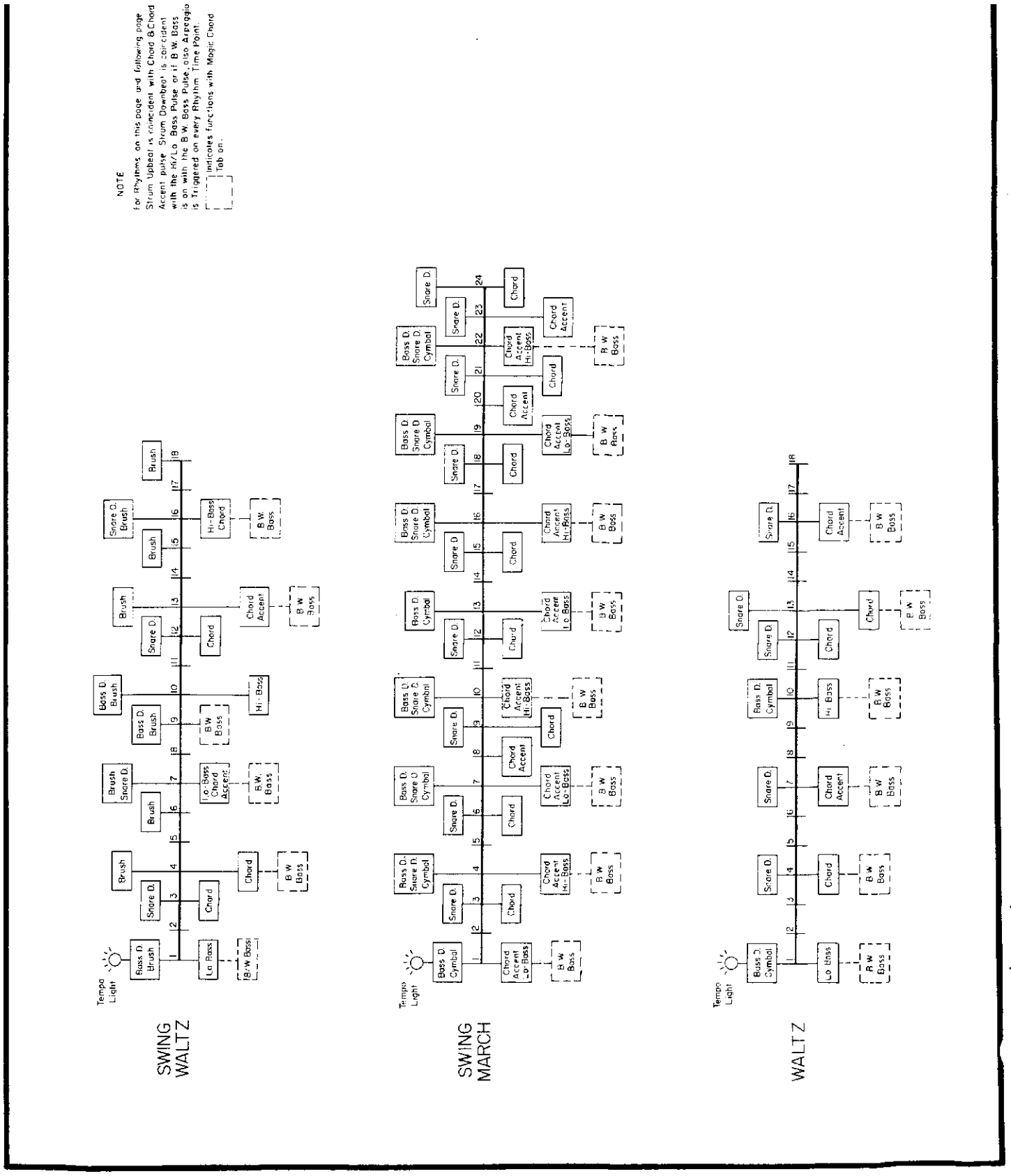


PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE
99?-npi1Q9	G	991-012328	F	991-016727	C	992-024185	G
991-002232	C	991-012396	F	991-016788	C	991-024184	C
991-002271	G	991-012686	F	992-017169	G	991-025535	E or M
991-002298	C	992-013170	A	991-017456	F	991-026039	G
991-002356	C	991-013543	C	991-018238	C	991-026040	G
991-002873	C	991-013544	C	991-018047	E	991-026028	G
991-002888	C	991-013599	C	991-018237	B	991-026054	C
992-003139	G	991-015000	A	991-018493	E	991-026617	C
991-003304	C	991-015001	A	992-020432	G	991-026315	C
991-008393	C	991-015062	A	991-020425	H		
991-008394	C	991-015063	A	991-020426	H		
992-008890	G	991-015316	K	992-022201	G		
991-010098	C	991-015587	C	991-021451	J		
991-010462	C	991-015614	C	991-021450	J		
991-011576	D	991-015663	C	992-022773	G		
. 991-011706	D	991-016274	C	991-022774	L		

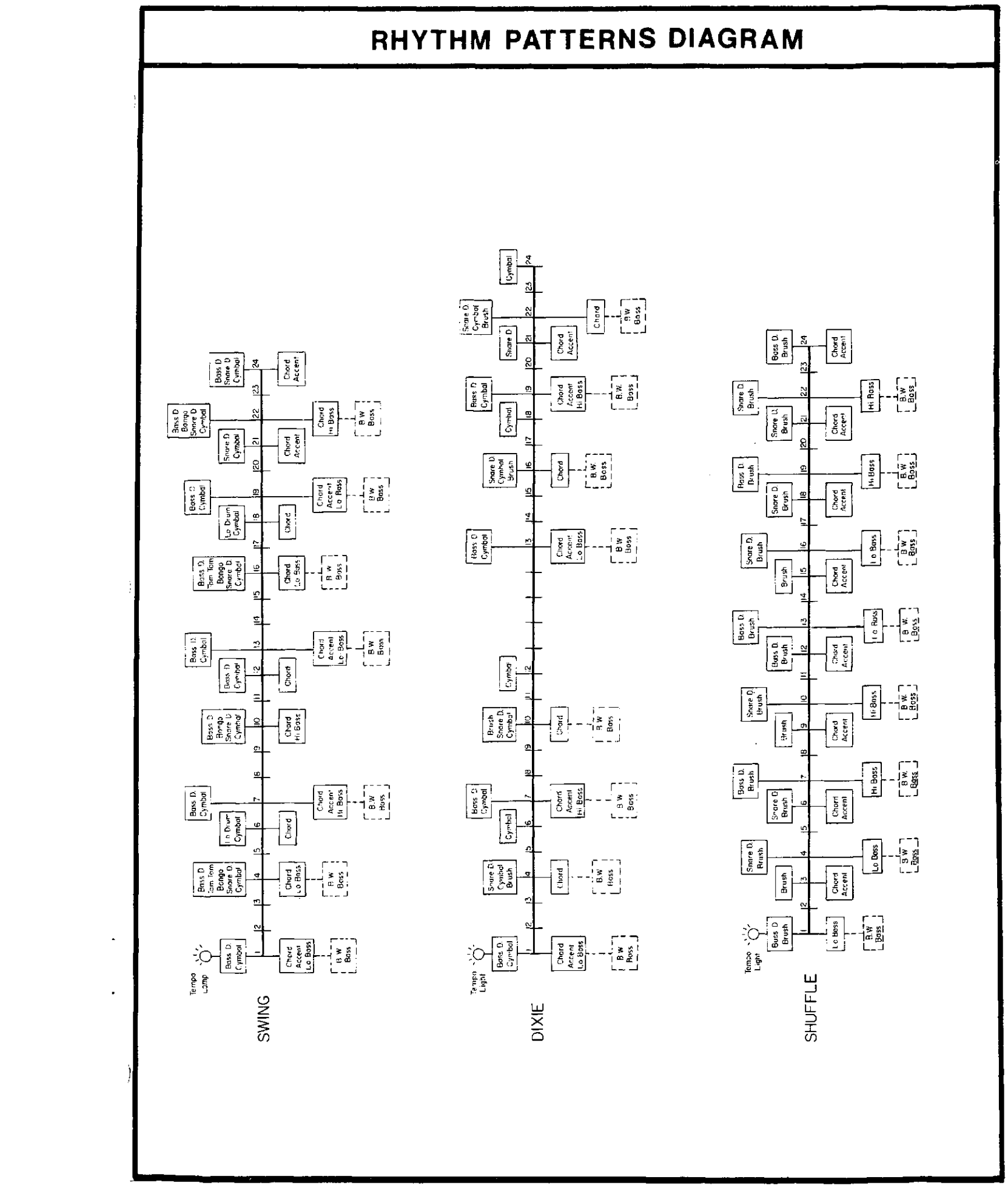
FREQUENCY DISTRIBUTION CHART



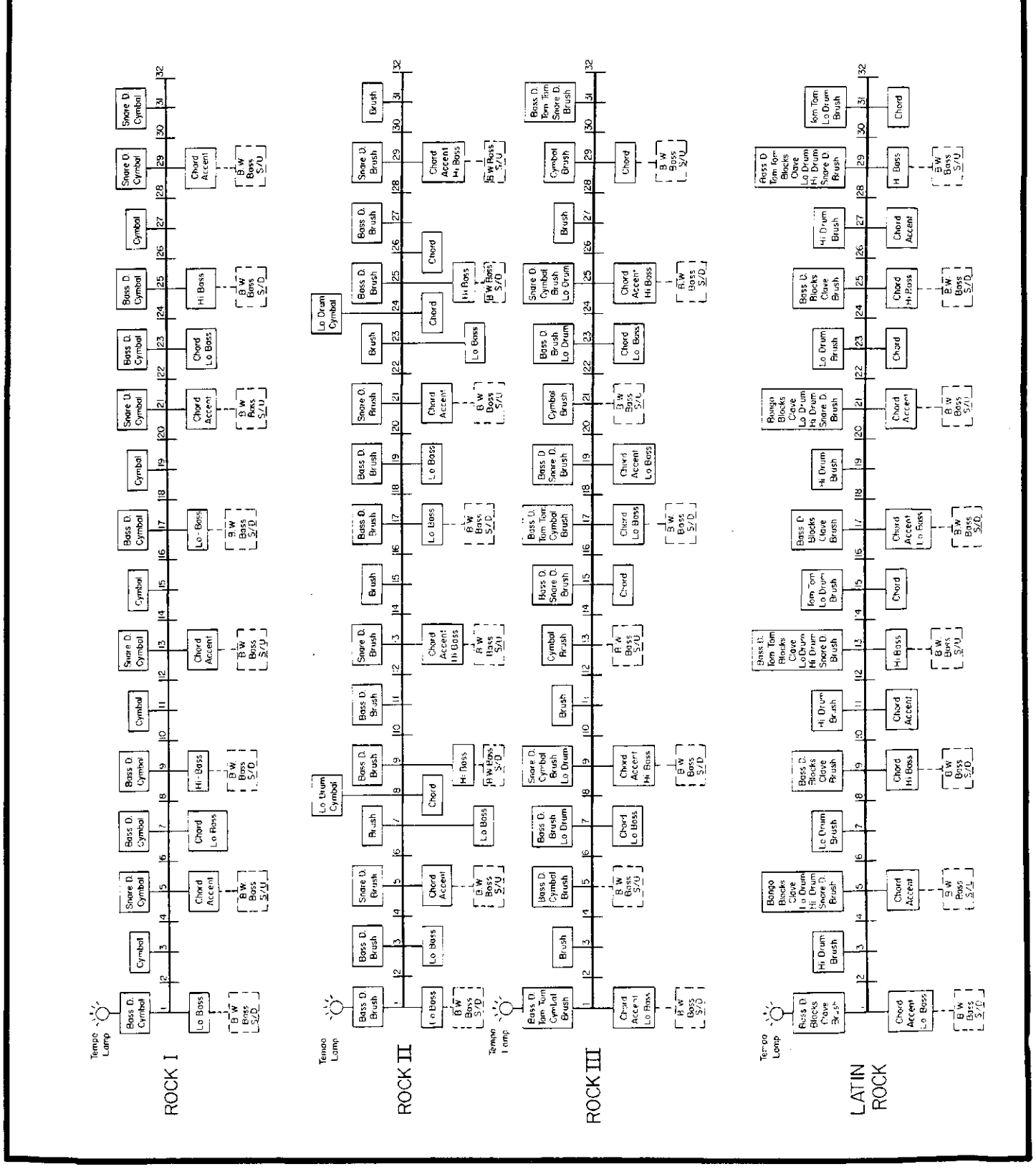
RHYTHM PATTERNS DIAGRAM



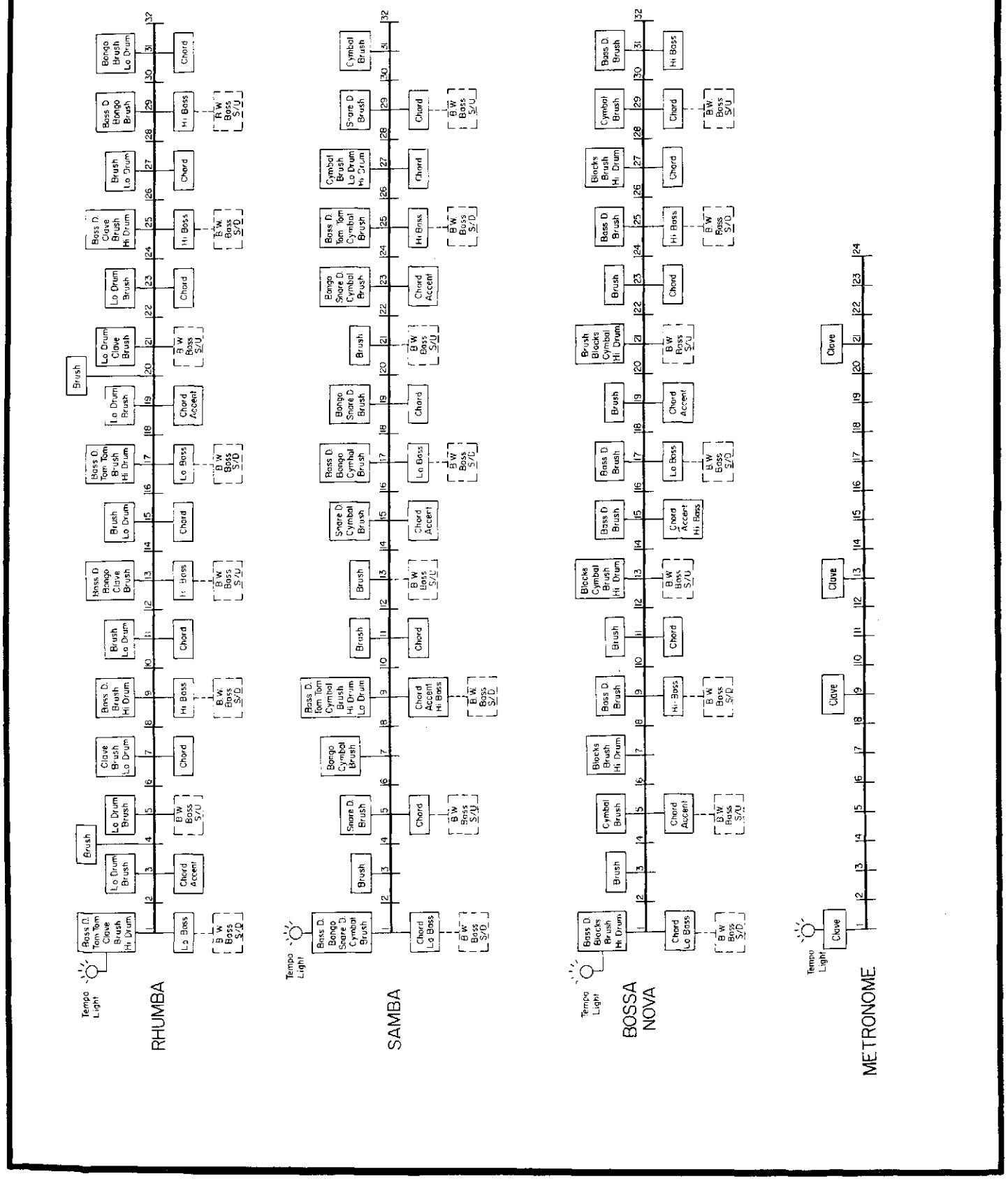
RHYTHM PATTERNS DIAGRAM



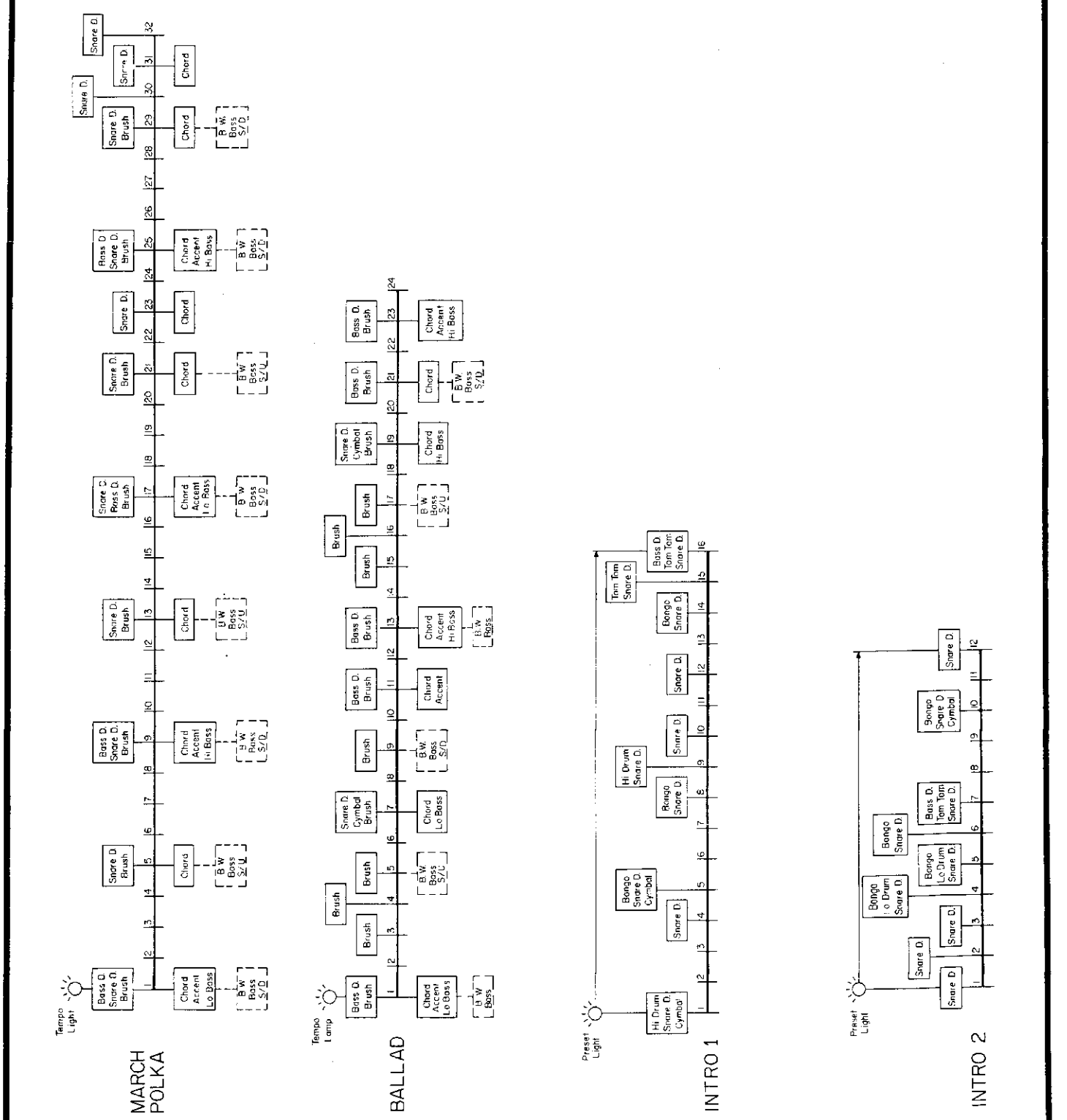
RHYTHM PATTERNS DIAGRAM



RHYTHM PATTERNS DIAGRAM



RHYTHM PATTERNS DIAGRAM



PARTS INFORMATION

STANDARD PARTS

Replacements for all standard electronic parts and.hardware may be purchased directly from local suppliers generally in less time than would be required to obtain them from the factory.

SPECIAL PARTS

In addition to the standard replacement parts, special electronic and mechanical parts are also used. These parts are manufactured by and to the specifications of the factory. Order these parts directly from the factory since they would be difficult or impossible to obtain from other sources.

PARTS ORDERING INFORMATION

When ordering parts be sure to include the following information:

1. Model and Serial Number
2. Part Number
3. A description of the part
4. Specify how you want the part shipped.

Most special electronic parts and mechanical parts will have a part number stamped on them. In the event that the part number is missing, or you are unable to read the part number, a complete description of the part and where it is used will allow the factory to fill your parts order. When parts are ordered in the proper manner the factory is able to.fill your orders promptly—delays that might result are avoided.

ADDRESS PARTS ORDERS TO:

LOWREY ELECTRONICS PARTS DEPARTMENT
4400 W. 45th Street
Chicago, Illinois 60632

IMPORTANT

IN ANY CORRESPONDENCE CONCERNING THIS INSTRUMENT ALWAYS INCLUDE MODEL AND SERIAL NUMBERS

PARTS LIST

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UPPER KEYING CONTROL & AOC BOARD ASSEMBLY. 103
UPPER/LOWER KEYSWITCH ASSEMBLY. 103

THE PARTS LIST CONTAINS THE FOLLOWING INFORMATION:

1. Name of Part
2. Value, Tolerance and Code (When Important)
3. Brief description
4. Where the part is found (assembly, printed circuit board, etc.)
5. Schematic Reference Number
6. PART NUMBER - USE IT!

This parts list includes all standard stock replacement parts. No attempt has been made to include every nut, bolt and screw. If the necessity for a non-listed part arises, please write describing the parts location and function as well as model and serial number of the unit.

PARTS LIST

Part	Description	Schematic Reference	Part Number
AMPLIFIER/EXPRESSION PEDAL/POWER SUPPLY & CROSSOVER ASSEMBLY			
Actuator	Arm		967-026076
Assembly	Control Arm		997-026151
Assembly	Glide Switch		997-028084
Assembly	Glide Switch		997-026150
Assembly	Glide Switch		997-026576
Assembly	Pedal & Mat		997-023127
Assembly	Power Supply		997-027667
Bulb	GE1819		939-003190
Capacitor	Electrolytic 10 uf 45V		945-008895-085
Capacitor	Electrolytic 500 Dual 40V		945-024505
Capacitor	Electrolytic 2500 uf Dual 25V		945-026659
Capacitor	Electrolytic 7500 45V		945-026652
Capacitor	Electrolytic 3500-2500 45V 3000 20V		945-026649
Capacitor	Electrolytic 50 uf 30V		945-008895-058
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V		945-008895-015
Capacitor	Electrolytic 15 uf 6V		945-008895-079
Capacitor	Electrolytic 2 uf 50V		945-026065
Capacitor	Electrolytic 50 uf 35V		945-008719-001
Capacitor	Crossover 60 uf		945-026788
Capacitor	Crossover 200 uf		945-025580
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Tantalum 27 uf 20% 35V		946-012624-276
Clip	Fuse		976-026063
Coil	Crossover 6.3 mh	L22	956-026066
Coil	Crossover 3.7 mh	L20	956-024553
Coil	Crossover 5 mh	L21	956-026787
Cord	Power		989-008717
Diffuser	White		922-015928-001
Diode	Bridge Rectifier 15 amps	D751	919-025522
Diode	1 amp 200V	D747, 752, 754-761	919-010623-001
Diode		D741-745, D748	919-024769
Diode	Bridge Rectifier 6 amps	D753	919-022736-003
Diode	4-junction	D746	919-026053
Fuse	5 amp 125V		939-013304-004
IC	-15V Regulator	IC175	992-026646-010
IC	-12V Regulator	IC176	992-026646-007
IC	+18V Regulator	IC172	992-024149-011
IC	Dual Op-Amp	IC166	991-025244
IC	+8V Regulator	IC170	992-024149-005
IC	+12V Regulator	IC173	992-024149-008
IC	+24V Regulator	IC171	992-024149-014
IC	+12V Regulator	IC174	992-024149-007
Mat	Glide Switch		959-009208-003
Mat	Glide Switch		959-009208-004
Mat	Swell Pedal		959-022953
Photocell	Expression Pedal	P5	948-018479
Potentiometer	25K Maximum Voltage Adjustment	VR63	925-021442-014

PARTS LIST

Part	Description	Schematic Reference	Part Number
AMPLIFIER/EXPRESSION PEDAL/POWER SUPPLY & CROSSOVER ASSEMBLY (Continued)			
Potentiometer	250 Ohm Voltage Adjustment	VR67	925-004349-012
Potentiometer	500K Minimum Volume Adjustment	VR64	925-024590
Resistor	WW 25 Ohm 10% 20W		924-006811-093
Resistor	WW 12 Ohm 10% 15W		924-006811-121
Resistor	WW 4 Ohm l 0% 15W		924-006811-120
Resistor	WW 150 Ohm 10% 2W		924-010471-151
Resistor	WW Fusible 5 Ohm 5W		924-026062-002
Resistor	WW Fusible .5 Ohm 5W		924-026062-003
Resistor	300 Ohm+5%		924-027382-301
Resistor	270 Ohm +5%		924-027382-271
Resistor	4700 5% 1W		851-251472
Socket	IC 8-Pin		906-021448
Spring	Compression		975-011747-001
Spring	Contact		917-027316
Transformer	Power	T1	954-026709
Transistor	NPN Darlington Driver	Q483	991-016727
Transistor	NPN Darlington Relay Driver	Q492	991-013543
Transistor	NPN Preamps	Q486, 487	991-026054
Transistor	PNP Driver	Q488	991-024184
Transistor	NPN Regulator, Switcher	Q485, 489	991-002232
Transistor	Power Darlington NPN Output	Q490	992-026039-002
Transistor	Power Darlington PNP Output	Q491	992-026040-002
BENCH ASSEMBLY			
Bench	Walnut		978-026396
CARILLON BOARD ASSEMBLY			
Capacitor	Metal Polyester .012 uf 5% 50V		946-026745-123
Capacitor	Metal Polyester .014 uf 5% 50V		946-026745-143
Capacitor	Metal Polyester .02 uf 5% 50V		946-026745-203
Capacitor	Metal Polyester .022 uf 5% 50V		946-026745-223
Capacitor	Metal Polyester .033 uf 5% 50V		946-026745-333
Capacitor	Metal Polyester .0047 uf 5% 50V		946-026745-472
Capacitor	Metal Polyester .0068 uf 5% 50V		946-026745-682
Capacitor	Metal Polyester .0082 uf 5% 50V		946-026745-822
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .0082 uf 10% 50V		946-026037-822
Diode		D62L	919-004799
Diode		All others	919-024769
IC	Quad Amp Carillon Filters	IC143	991-024103
Network	Reed String		949-024537
Socket	14-Pin		906-018905
Transistor	NPN Darlington Carillon Keyers	Q441-465	991-026617

PARTS LIST

Part	Description	Schematic Reference	Part Number
CHORD FUNCTION GENERATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 25 uf 25V	C13	945-008895-008
Capacitor	Electrolytic 2x2 uf 30V Dual		945-024186
Capacitor	Tantalum 1.0 uf 20% 35V		946-012624-105
Capacitor	Tantalum .22 uf 20% 35V		946-012624-224
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		All	919-024769
IC	Chord Function Generator	IC85	991-026003
IC	Dual D Flip-Flop	IC89, 90	991-025225
IC	Quad Dual Input OR Gate	IC86, 87	991-025516
IC	Quad Dual Input NAND Gate	IC91	991-025515
IC	Quad Dual Input AND Gate	IC88	991-025517
IC	Quad Dual Input NAND Gate	IC92	991-024593
Network	23-Pin		949-024737
Potentiometer	50K 20% Chord Level Adjustment	VR40	925-004349-007
Socket	14-Pin		906-018905
Socket	40-Pin		906-022727
Transistor	NPN	Q271-274, 278-280, 284, 285, 289-292	991-002232
Transistor	NPN Preamps	Q275-277	991-002298
CHORUS MODULATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 200 uf 25V	C7	945-008895
Capacitor	Electrolytic 6 uf 20V		945-008895-007
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 100 uf 25V	C1-C4	945-008895-045
Capacitor	Electrolytic 20 mfd 25V		945-008895-030
Capacitor	Electrolytic 1 uf 35V		945-008895-015
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 2 uf 20V		945-008895-032
Capacitor	Electrolytic 500 uf 18V	C6	945-008895-080
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		D290-292	919-024769
IC	Bucket Brigade	IC79, 81, 83	991-020077-001
IC	Volume Regulator	IC164, 165	991-021444-001
IC	Voltage Controlled Oscillator	IC78, 80, 82	991-024543
Network			949-020068
Potentiometer	250K 20% Clock 1 Speed Adjustment	VR27	925-004349-002
Potentiometer	1M 20% Clock 2 Speed Adjustment	VR26	925-004349-004
Potentiometer	2500 Ohm 20% Phase 1,2,3 Level Adjustment	VR28, 29, 30	925-004349-011
Socket	IC 8-Pin		906-021448
Socket	IC 6-Pin		906-021448-001
Transistor	NPN Input Preamps Phase 1,2,3 Output Amps	Q203,204,222,230,238	991-002298
Transistor	NPN Oscillator	Q206-213,213,216,224 232	991-008393
Transistor	NPN Phase 1,2,3 Splitters	Q217-219,225-227, 233-235	991-010462

PARTS LIST

Part	Description	Schematic Reference	Part Number
CHORUS MODULATOR BOARD ASSEMBLY (Continued)			
Transistor	NPN Darlington	Q215,220,221,223,228, 229,231,236,237	991-013543
Transistor	Clock 1 & 2	Q205, 214	991-015316
CONSOLE ASSEMBLY			
Back	Walnut		972-026612
Key Cap (1)	Plastic (Black)		
Key Cap (2)	Plastic (White)		
Key Cap (3)	Complete (Black or White)		
	(1) All are identical. (2) Include Key Letter designation. (Example: A or F, etc.) (3) Available on special order only. Include Key Letter designation and Key location. Replacement keys will require special hand-fitting due to the hand-built construction of keyboards.		
Rail	Up-stop		936-027378
Reverb	Spring Unit		984-017447
Speaker	12-inch, 4 ohm Base Main & Leslie		985-026627
Speaker	6x9-inch, 8 ohm Phase 2 & 3		985-009960-00S
Speaker	8-inch, 8 ohm Main		985-003185-00;
DC CONTROL BOARD ASSEMBLY			
Capacitor	Electrolytic 2 uf 50V		945-008895-065
Capacitor	Electrolytic 1 uf 25V		945-008895-038
Capacitor	Electrolytic 1 uf 35V		945-008895-045
Capacitor	Electrolytic 6 uf 20V		945-008895-057
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .15 uf 10% 50V		946-026037-154
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .039 uf 10% 50V		946-026037-393
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .082 uf 10% 50V		946-026037-823
Capacitor	Tantalum 100 uf 10V		945-021452-100
Capacitor	Tantalum 1.0 uf 20% 35V		946-012624-104
Capacitor	Tantalum .22 uf 20% 35V		946-012624-224
Diode	Zener 10V	Z1	919-017406-05
Diode		D487	919-004799-001
Diode	Triple	D253	919-010454-001
Diode		All others	919-024769
IC	Dual Op-Amp	IC18	991-025244
IC	Quad Op-Amp	IC20	991-024103
IC	Quad Dual Input NAND Gate	IC1, 57	991-024593
IC	Dual D Flip-Flop	IC51, 52, 58	991-025225
IC	Quad Dual Input No.2 Gate	IC19	991-025536
IC	Hex Schmitt Trigger	IC21	991-025576

PARTS LIST

Part	Description	Schematic Reference	Part Number
DC CONTROL BOARD ASSEMBLY (Continued)			
Potentiometer	1M 20% Rest Adjustments	VR4, VR22	925-004349-004
Potentiometer	100K 20% Vibrato Speed Adjustment	VR1	925-004349-010
Resistor	WW 33 10% 2W		924-010471-330
Socket	14-Pin		906-018905
Transistor	NPN	Q332-338, 348-350	991-026315
Transistor	NPN	Q1,6,7,38-44,47-50,52-54,93-100,102,104,128	991-002232
Transistor	NPN Genie Accomp. Switcher	Q127	991-002298
Transistor	NPN	Q3, 34, 166	991-008393
Transistor	PNP	Q35,37,56-67,105-113, 126,167,495	991-010098
Transistor	NPN Vibrato Delay & Cancel Switcher	Q2	991-013544
Transistor	PNP Upper Keyboard Keyswitch Buss Driver.	Q101	991-013599
Transistor	NPN Darlington	Q4, 45, 46, 51, 55	991-016727
Transistor	NPN Sustain Length Regulator	Q36	991-020425-001
GOLDEN HARP BOARD ASSEMBLY			
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Diode		All	919-024769
IC	Dual D Flip-Flop	IC147	991-025225
IC	Up/Down Decoder	IC154..'	991-024595
IC	Quad Dual Input NAND Gate	IC149,150	991-025515
IC	Quad Dual Input AND Gate	IC151, 157	991-025517
IC	Octave Count Decoder	IC156	991-026023
IC	Counters	IC153, 155	991-026024
IC	Quad Dual Input NOR Gate	IC148	991-026025
IC	DualJ-K Flip-Flop	IC152	991-026022
Socket	14-Pin		906-018905
Socket	16-Pin		906-018905-001
Socket	24-Pin		906-018905-002
Transistor	NPN	Q469-471, 474-479	991-002232
Transistor	NPN	Q472, 473	991-008393
LESLIE TREMOLO UNIT			
Assembly	Leslie Unit Complete		984-026339
Assembly	Motor		138756
Assembly	Rotor and Shaft		138761
Bearing	Plastic		137264
Belt	Drive		138675
Grommet	Neoprene		137255
Speaker	10-inch, 8-ohm		017202
Support	Rotor, Back		137256
Support	Rotor, Hub		137533
Support	Rotor, Steel Rod		138775

PARTS LIST

Part	Description	Schematic Reference	Part Number
LOWER FLUTE & SYMPHONIC STRING FILTER BOARD ASSEMBLY			
Capacitor	Electrolytic 10 uf 15V.		945-019366-003
Capacitor	Electrolytic 25 uf 25V.	C29, 38	945-008895-008
Capacitor	Electrolytic 10 uf 20V.		945-008895-009
Capacitor	Electrolytic 1 uf 20V.		945-008895-011
Capacitor	Electrolytic 1 uf 35V.		945-008895-015
Capacitor	Electrolytic 4 uf 35V.		945-008895-016
Capacitor	Electrolytic 100 uf 10V.	C11	945-008895-020
Capacitor	Electrolytic 2 uf 50V.		945-008895-065
Capacitor	Metal Polyester .01 uf 5% 50V.		946-026745-103
Capacitor	Metal Polyester .0015 uf 5% 50V.		946-026745-152
Capacitor	Metal Polyester .014 uf 5% 50V.		946-026745-143
Capacitor	Metal Polyester .0012 uf 5% 50V.		946-026745-122
Capacitor	Metal Polyester .0016 uf 5% 50V.		946-026745-162
Capacitor	Metal Polyester .02 uf 5% 50V.		946-026745-203
Capacitor	Metal Polyester .0024 uf 5% 50V.		946-026745-242
Capacitor	Metal Polyester .027 uf 5% 50V.		946-026745-273
Capacitor	Metal Polyester .0033 uf 5% 50V.		946-026745-332
Capacitor	Metal Polyester .039 uf 5% 50V.		946-026745-393
Capacitor	Metal Polyester .0047 uf 5% 50V.		946-026745-472
Capacitor	Metal Polyester .056 uf 5% 50V.		946-026745-563
Capacitor	Metal Polyester .0068 uf 5% 50V.		946-026745-682
Capacitor	Polystyrene .001 uf 10% 50V.		946-026037-102
Capacitor	Polystyrene .015 uf 10% 50V.		946-026037-153
Capacitor	Polystyrene .01 uf 10% 50V.		946-026037-103
Capacitor	Polystyrene .1 uf 10% 50V.		946-026037-104
Capacitor	Polystyrene .0015 uf 10% 50V.		946-026037-152
Capacitor	Polystyrene .0018 uf 10% 50V.		946-026037-182
Capacitor	Polystyrene .022 uf 10% 50V.		946-026037-223
Capacitor	Polystyrene .0022 uf 10% 50V.		946-026037-222
Capacitor	Polystyrene .22 uf 10% 50V.		946-026037-224
Capacitor	Polystyrene .0033 uf 10% 50V.		946-026037-332
Capacitor	Polystyrene .039 uf 10% 50V.		946-026037-393
Capacitor	Polystyrene .047 uf 10% 50V.		946-026037-473
Capacitor	Polystyrene .0047 uf 10% 50V.		946-026037-472
Capacitor	Polystyrene .0068 uf 10% 50V.		946-026037-682
Capacitor	Polystyrene .0082 uf 10% 50V.		946-026037-822
Capacitor	Polystyrene .0056 uf 10% 50V.		946-026037-562
Capacitor	Tantalum 5.6 uf 25V.		946-021452-001
Diode		All	919-024769
IC	Quad Op-Amp.	IC39-45	991-024103
IC	Quad Op-Amp.	IC46-48	991-025267
IC	Op-Amp.	IC163	991-021444-001
Network	Reed String.		949-024537
Socket	14-Pin.		906-018905
Socket	8-Pin.		906-021448
Transistor	FET Audio Switchers.	Q82-85,87,89,119,120.	991-022774
Transistor	NPN Switcher, Preamp.	Q86, 88	991-018238
Transistor	NPN Darlington.	Q485	991-026617

PARTS LIST

Part	Description	Schematic Reference	Part Number
LOWER KEYING CONTROL & DIODE READOUT BOARD ASSEMBLY			
Capacitor	Electrolytic 2x2 uf 30V Dual		Q4*>n94i«fl
Capacitor	Tantalum 2.2 uf 35V		Ltoi262₄.225
Network			" J ™ "
MAGIC GENIE 4-FOOT TOS, AOC & OSCILLATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 10 uf 15V		945-019366 003
Capacitor	Electrolytic 25 uf 15V	C18	945-008895-029
Capacitor	Electrolytic 10 uf 20V		945-008895 009
Capacitor	Polystyrene 200 pf 5% 63V		946-024767-005
Coil	Chord Tuning Adjustment	L13	952-018874-006
Diode		°372	919-024117
Diode		D373	919-010873
Diode	All others		919-024769
IC	DualDFliP-Flop	IC93-96	991-025225
IC	33-Bit Decoder	IC99	991-022793
IC	4-Foot TOS	IC98	991-018813-001
IC	tZ°0t S I C 97		991-018813-002
Network	22K		949-025521-001
Network	100K		949-025521-002
Network	470K		949-025521-003
Resistor	WW 220 Ohm 10% 2W		924-010471-221
Socket	40-Pin		906-022727
Socket	14-Pin		906-018905
Transistor	NPN Chord Function Master Oscillator	Q287	991-025535
Transistor	NPN	Q281,282,286,288	991-002232
Transistor	NPN Darlington	Q283	991-026617
AA1N & PEDAL QC BOARD ASSEMBLY			
Capacitor	Electrolytic 500 uf 18V	C10	945-008895-080
Capacitor	Electrolytic 50 uf 15V	C31, 37	945-008895-005
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V		945-008895-015
Capacitor	Electrolytic 100 uf 10V		945-008895-020
)apacitor	Electrolytic 100 uf 15V		945-008895-044
lapacitor	Electrolytic 100 uf 25V		945-008895-045
Capacitor	Electrolytic 2 uf 50V		945-008895-065
lapacitor	Polystyrene .015 uf 10% 50V		946-026037-153
lapacitor	Polystyrene .15 uf 10% 50V		946-026037-154
lapacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
apacitor	Polystyrene .22 uf 10% 50V		946-026037-224
apacitor	Polystyrene .0033 uf 10% 50V		946-026037-332
iapacitor	Polystyrene .033 uf 10% 50 V		946-026037-333
apacitor	Polystyrene .33 uf 10% 50 V		946-026037-334
apacitor	Polystyrene .0039 uf 10% 50V		946-026037-392
apacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
apacitor	Polystyrene .047 uf 10% 50V		946-026037-473
apacitor	Polystyrene .0068 uf 10% 50V		946-026037-682

PARTS LIST

Part	Description	Schematic Reference	Part Number
MAIN & PEDAL QC BOARD ASSEMBLY (Continued)			
Capacitor	Polystyrene .068 uf 10% 50V.		946-026037-683
Capacitor	Polystyrene .0082 uf 10% 50V.		946-026037-822
Capacitor	Polystyrene .1 uf 10% 50V.		946-026037-104
Capacitor	Tantalum 5.6 uf 25V.		946-021452-001
Diode		All	919-024769
IC	Op-Amp.	IC55,62,66,67,74,75,102	991-021444-001
IC	Dual Op-Amp.	IC56, 73, 161	991-025244
IC	Quad Op-Amp.	IC61, 65	991-024103
IC	Quad Op-Amp.	IC63,64	991-025267
Network	Reed String.		949-024537
Potentiometer	50K 20% Genie, Percussion Thump Adjust..	VR15,19	925-004349-007
Socket	IC 8-Pin.		906-021448
Socket	14-Pin.		906-018905
Transistor	NPN Bass Med.,Bass Full Switchers.	Q198, 199	991-002232
Transistor	NPN Bass Emitter Follower.	Q200	991-002298
Transistor	NPN Switcher.	Q147	991-008393
Transistor	NPN Darlington Emitter Followers.	Q149,150,195,196 ..	991-016727
Transistor	FET Audio Switch.	All others.	991-022774
Transistor	NPN Darlington Main Output Amp.	Q484	991-026617
ORCHESTRAL SYMPHONIZER KEYER BOARD ASSEMBLY			
Diode		All	919-024769
Transistor	Pulse Keyer.	Q405, 407	991-008393
ORCHESTRAL SYMPHONIZER KEYING CONTROL BOARD 1 & 2			
Capacitor	Polystyrene .22 uf 10% 50V.		946-026037-224
Capacitor	Polystyrene .27 uf 10% 50V.		946-026037-274
Capacitor	Polystyrene .33 uf 10% 50V.		946-026037-334
Diode		All others..	919-024769
Diode		D556, 557	919-004799
Transistor	NPN Darlington Orch. Symp. Keyer.	Q404, 406	991-026617
ORCHESTRAL SYMPHONIZER LATCH BOARD ASSEMBLY			
Capacitor	Electrolytic 25 uf 25V.	C26	945-008895-008
Capacitor	Electrolytic 2 uf 50V.		945-008895-065
Capacitor	Electrolytic 6 uf 20V.		945-008895-007
Capacitor	Polystyrene .033 uf 10% 50V.		946-026037-333
Diode		All	919-024769
IC	Up/Down Decoder.	IC120	991-024595
IC	8-Bit Priority Encoder.	IC113, 114	991-025599
IC	Dual D Flip-Flop.	IC115,116	991-025225
IC	Quad Dual Input Exclusive OR Gate.	IC117	991-026005
IC	Dual Up Counter.	IC119	991-026006
IC	Quad Dual Input NOR Gate.	IC118	991-025536
Socket	14-Pin.		906-018905
Socket	16-Pin.		906-018905-001
Socket	24-Pin.		906-018905-002
Transistor	PNP Low Voltage Keying Switcher.	Q393	991-013599

PARTS LIST

Part	Description	Schematic Reference	Part Number
ORCHESTRAL SYMPHONIZER LATCH BOARD ASSEMBLY (Continued)			
Transistor	NPN Darlington	Q397	991-016727
Transistor	NPN	Q389,392,398-401,403	991-013544
Transistor	NPN	Q390, 394, 395	991-002232
Transistor	PNP	All others	991-010098
Transistor	NPN Darlington	Q391	991-015663
ORCHESTRAL SYMPHONIZER QUALITY CONTROL BOARD ASSEMBLY			
Capacitor	Electrolytic 50 uf 15V		945-008895-005
Capacitor	Electrolytic 25 uf 25V	C9, 36	945-008895-008
Capacitor	Electrolytic 15 uf 50V		945-008895-003
Capacitor	Electrolytic 1 uf 35V		945-008895-015
Capacitor	Electrolytic 4 uf 35V		945-008895-016
Capacitor	Electrolytic 100 uf 10V	C34, 42	945-008895-020
Capacitor	Electrolytic 20 mfd 25V		945-008895-030
Capacitor	Electrolytic 100 uf 15V		945-008895-044
Capacitor	Electrolytic 500 uf 18V	C33, 41	945-008895-080
Capacitor	Electrolytic 2 uf 50V		945-008895-065
Capacitor	Electrolytic 10 uf 25V		945-008895-091
Capacitor	Polystyrene .047 uf 10% 50V		946-026037-473
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Capacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .012 uf 10% 50V		946-026037-123
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .0015 uf 10% 50V		946-026037-152
Capacitor	Polystyrene .0033 uf 10% 50V		946-026037-332
Capacitor	Polystyrene .0039 uf 10% 50V		946-026037-392
Capacitor	Polystyrene .027 uf 10% 50V		946-026037-273
Capacitor	Polystyrene .001 uf 10% 50V		946-026037-102
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .0012 uf 10% 50V		946-026037-122
Capacitor	Polystyrene .15 uf 10% 50V		946-026037-154
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .018 uf 10% 50V		946-026037-183
Capacitor	Polystyrene .039 uf 10% 50V		946-026037-393
Capacitor	Polystyrene .0082 uf 10% 50V		946-026037-822
Capacitor	Tantalum 2.2 uf 35V		946-012624-225
Diode		All others	919-024769
Diode		D525-535	919-004799
IC	Op-Amp	IC133-136	991-021444-001
IC	Quad Op-Amp	IC123-130,132,139	991-025267
IC	Dual Op-Amp	IC131	991-025244
IC	Bucket Brigade	IC140	991-025584
Potentiometer	10K 20% Bias Adjustment	VR53	925-004349-003

PARTS LIST

Part	Description	Schematic Reference	Part Number
ORCHESTRAL SYMPHONIZER QUALITY CONTROL BOARD ASSEMBLY (Continued)			
Potentiometer	1M 20% Speed Adjustment	VR54	925-004349-004
Socket	IC 8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor	PNP	Q435,436,437,438	991-010098-003
Transistor	PNP Chorus Enable	Q434	991-010098-004
Transistor	NPN Darlington	Q421, 422, 430, 434	991-016727
Transistor	NPN Darlington	Q429	991-013543
Transistor	NPN	Q416	991-002232
Transistor	FET Audio Switch	Q411-415, 418-470, 423-428	991-022774
Transistor	NPN Darlington	Q384	991-015663
Transistor	NPN	All others	991-013544
RHYTHM CLOCK BOARD ASSEMBLY			
Capacitor	Electrolytic 1000 uf 15V	C21	945-008895-061
Diode		All	919-024769
IC	Resettable Counter	IC102	991-018495
IC	ROM	IC103	991-022729
Socket	40-Pin		906-022727
Socket	16-Pin		906-018905-001
Transistor	NPN	All others	991-008393
Transistor	PNP	Q184,295,296,311-313, 318,319,322-324,326-329	991-010098
Transistor	NPN Darlington Driver	Q185, 300	991-016727
Transistor	PNP Darlington Clock Multivibrator	Q297, 298	991-018493
Transistor	NPN Intro Hold Reset	Q315	991-002232
RHYTHM INSTRUMENTATION BOARD ASSEMBLY			
Capacitor	Electrolytic 50 uf 25V	C14, 43	945-027385
Capacitor	Electrolytic 2 uf 25V		945-015619
Capacitor	Metal Polyester .0068 uf 20% 50V		946-026795-682
Capacitor	Metal Polyester .1 uf 20% 50V		946-026795-104
Capacitor	Metal Polyester .22 uf 20% 50V		946-026795-224
Capacitor	Metal Polyester .12 uf 5% 50 V		946-026745-124
Capacitor	Metal Polyester .0039 uf 5% 50V		946-026745-392
Capacitor	Metal Polyester .0018 uf 5% 50V		946-026745-182
Capacitor	Metal Polyester .0022 uf 5% 50V		946-026745-222
Capacitor	Metal Polyester .0056 uf 5% 50V		946-026745-562
Capacitor	Metal Polypropylene .068 uf 5% 50V		946-026784-683
Capacitor	Metal Polypropylene .1 uf 5% 50V		946-026784-104
Capacitor	Metal Polypropylene .033 uf 5% 50V		946-026784-333
Capacitor	Metal Polypropylene .039 uf 5% 50V		946-026784-393
Capacitor	Polypropylene .0051 uf 2.5% 50V		946-027302-512
Capacitor	Polypropylene .01 uf 2.5% 50V		946-027302-103
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104

PARTS LIST

Part	Description	Schematic Reference	Part Number
RHYTHM INSTRUMENTATION BOARD ASSEMBLY (Continued)			
Diode		D484-486	919-004799
Diode		All others	919-024769
IC	Digital Noise Generator	IC110	991-024108
IC	Quad Op-Amp	IC107-109	991-022794
IC	Hex Inverter	IC106	991-024594
Socket	8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor	NPN	All others	991-026315
Transistor	PNP Genie Modulator Keyer	Q309	991-010098
TAB PANEL ASSEMBLY			
Bulb			939-018289
Guide	Slider		976-005170-001
Jack	Headphone		910-024526
Knob	White Pearl		915-026335-001
Knob	Red Variegated		915-026335-002
Knob	Blue Variegated		915-026335-003
Knob	Yellow Variegated		915-026335-004
Knob	Green Variegated		915-026335-005
Knob	Gray Variegated		915-026335-006
Lens	White		922-018413-001
Lens	Red		922-018413-002
Lens	Blue		922-018413-003
Lens	Yellow		922-018413-004
Lens	Green		922-018413-005
Potentiometer	10K Sustain Length, Rhythm Balance, Reverb Length	VR5,46, 62	925-021442-007
Potentiometer	5K Vibrato Depth Control	VR2	925-021442-008
Potentiometer	100K Vibrato Speed, Wow Range Control	VR3, 23	925-021442-009
Potentiometer	1M Rhythm Speed Control	VR43	925-021442-010
Potentiometer	1.5M Repeat Speed Control	VR6	925-021442-011
Potentiometer	10K Lower Flute Volume, Upper String Volume, Lower String/Vox Volume, Genie Volume, Arpeggio Volume, Strum Volume	VR9,11,12,16,38,39	925-021442-012
Potentiometer	500K Harp Speed Control	VR60	925-021442-015
Potentiometer	IK Orch. Volume Control	VR51	925-021442-016
Potentiometer	10K Rhythm Volume	VR47	925-021442-017
Pushbutton	White Pearl	•	915-024199-007
Pushbutton	Black		915-024199-017
Pushbutton	Gray Variegated	••	915-024199-005
Pushbutton	Red Variegated		915-024199-008
Pushbutton	Yellow Variegated		915-024199-009
Pushbutton	Green Variegated		915-024199-006
Pusher	Medium		964-025555
Socket	Lamp		906-026038
Spring	Toggle		975-025543
Spring	Contact		917-005166-004
Switch	Pushbutton	•	960-018286
Switch	Pushbutton AC	••	960-026662-001

PARTS LIST

Part	Description	Schematic Reference	Part Number
TAB PANEL ASSEMBLY (Continued)			
Switch	On/Off White		960-010669-004
Switch	Pushbutton 6-Position		960-024525-001
Switch	Pushbutton 4-Position		960-024525-003
Switch	Pushbutton 17-Position		960-024525
Tab	A 0 C		915-025544-005
Tab	Accordion		915-025544-010
Tab	Banjo		915-025544-014
Tab	Bass Full		915-025544-048
Tab	Bass Medium		915-025544-049
Tab	Boogie Woogie Bass		915-025544-025
Tab	Cello 16		915-025544-023
Tab	Chord Hold		915-025544-031
Tab	Diaphone 16		915-025544-076
Tab	Electric Piano		915-025544-016
Tab	English Horn 8		915-025544-060
Tab	Flute 16		915-025544-039
Tab	Flute 8		915-025544-038
Tab	Flute 5-1/3		915-025544-037
Tab	Flute 4		915-025544-036
Tab	Flute 2-2/3		915-025544-035
Tab	Flute 2		915-025544-034
Tab	Flute 1		915-025544-069
Tab	Genie Guitar Bass		915-025544-050
Tab	Genie Plus Organ		915-025544-043
Tab	Genie String Bass		915-025544-051
Tab	Golden Harp		915-025544-077
Tab	Guitar		915-025544-045
Tab	Guitar Strum		915-025544-030
Tab	Harmonic 2-2/3		915-025544-012
Tab	Harmonic 4		915-025544-013
Tab	Harpsichord		915-025544-024
Tab	Harpsichord Arpeggio		915-025544-026
Tab	Hawaiian Guitar		915-025544-018
Tab	Kinura8		915-025544-040
Tab	Magic Genie Chords		915-025544-032
Tab	Mandolin		915-025544-015
Tab	Orchestral Clarinet		915-025544-011
Tab	Orchestral to Lower		915-025544-083
Tab	Orchestral to Pedal		915-025544-059
Tab	Pedal 8		915-025544-055
Tab	Pedal 16		915-025544-056
Tab	Pedal Guitar Bass		915-025544-054
Tab	Pedal Sustain		915-025544-057
Tab	Pedal Wow		915-025544-052
Tab	Percuss Long		915-025544-004
Tab	Piano		915-025544-017
Tab	Piano Arpeggio		915-025544-027
Tab	Piccolo		915-025544-009
Tab	Repeat Percuss		915-025544-003
Tab	Rhythm Start		915-025544-046
Tab	Rhythm Start Auto		915-025544-047

PARTS LIST

Part	Description	Schematic Reference	Part Number
TAB PANEL ASSEMBLY (Continued)			
Tab	Strum Downbeat		915-025544-028
T,ab	Sustain		915-025544-002
lab	Symphonic Wow		915-025544-007
Tab	Trombone 16		915-025544-042
Tab	Trumpet 16		915-025544-041
I™	Ukulele		915-025544-044
Tab	Ukulele Strum		915-025544-029
T,ab	Vibes		915-025544-020
Tab	VibraHarp		915-025544-019
Tab	Vibrato		915-025544-006
Tab	Viola 8		915-025544-022
Tab	Violin		915-025544-008
Tab	Violina4		915-025544-021
Tab	Vox Celeste 4		915-025544-079
Tab	Vox Humana 8		915-025544-066
Tab	Wow Attack Slow		915-025544-001
TONE GENERATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 50 uf 20V	C16	945-008895-012i
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 4 uf 20V		945-002333
Capacitor	Electrolytic 1 uf +50 -10% 50V		945-016692
Capacitor	Polystyrene .22 uf 10% 50V (on stand-up board)		946-026037-224
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .0056 uf 10% 50V		946-026037-562
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene 150 pf 2-1/2% 33V		946-013181-151
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Capacitor	Tantalum 1.0 uf 35V		946-021452-002
Coil	28 uh Tuning Adjustment	LI	952-018874-002
Diode	Glide	D1L	919-024117
Diode		All others	919-024769
Diode		D225, 229, 230	919-004799
Diode	(On stand-up board)	D243	919-024769
IC	TOS	IC2	991-018813-001
IC	TOS	IC3	991-018813-002
IC	6-stage Divider	IC4-15, 70	991-021331-002
Resistor	WW 220 Ohm 10% 2W		924-010471-221
Socket	14-Pin		906-018905
Transistor	NPN Darlington Collector Amps	Q164, 165	991-016727
Transistor	NPN	Q172, 173	991-013544
Transistor	PNP	Q171	991-015614
Transistor	NPN Keyer	Q170	991-018238
Transistor	NPN Darlington Keyer	Q155	991-026617
Transistor	PNP	Q158, 163,169,174	991-010098
Transistor	NPN	Q5, 157, 162, 168, 175, 176	991-002232

PARTS LIST

Part	Description	Schematic Reference	Part Number	(
TONE GENERATOR BOARD ASSEMBLY (Continued)				
Transistor	NPN	Q156, 161	991-008393	
Transistor	NPN Master Oscillator, Buffers	Q8-10	991-025535	
TONE GENERATOR BUFFER BOARD ASSEMBLY				
Capacitor	Metal Polyester .001 uf 20% 50V		946-026795-102	
Capacitor	Metal Polyester .0022 uf 20% 50V		946-026795-222	
Capacitor	Metal Polyester .0047 uf 20% 50V		946-026795-472	
Capacitor	Metal Polyester .01 20% 50V		946-026795-103	
Capacitor	Metal Polyester .022 uf 20% 50V		946-026795-223	
Capacitor	Metal Polyester .033 uf 20% 50V		946-026795-333	
Capacitor	Metal Polyester .047 uf 20% 50V		946-026795-473	
Capacitor	Metal Polyester .068 uf 20% 50V		946-026795-683	
Capacitor	Metal Polyester .1 uf 20% 50V		946-026795-104	
Diode		All	919-024769	
Transistor	PNP Buffers	Q11-29	991-010098	
UPPER DIODE READOUT BOARD ASSEMBLY				
Diode		All	919-024769	
Network	14-Pin		949-022779	
UPPER FLUTE & SYMPHONIC STRING FILTER BOARD ASSEMBLY				
Capacitor	Electrolytic 75 uf 10V		945-024539	
Capacitor	Electrolytic 1 uf 20V		945-008895-011	
Capacitor	Electrolytic 4 uf 35V		945-008895-016	
Capacitor	Electrolytic 2 uf 50V		945-008895-065	
Capacitor	Metal Polyester .001 uf 5% 50V		946-026745-102	
Capacitor	Metal Polyester .01 uf 5% 50V		946-026745-103	
Capacitor	Metal Polyester .1 uf 5% 50V		946-026745-104	
Capacitor	Metal Polyester .0015 uf 5% 50V		946-026745-152	
Capacitor	Metal Polyester .15 uf 5% 50V		946-026745-154	
Capacitor	Metal Polyester .12 uf 5% 50V		946-026745-124	
Capacitor	Metal Polyester .015 uf 5% 50V		946-026745-153	
Capacitor	Metal Polyester .0016 uf 5% 50V		946-026745-162	
Capacitor	Metal Polyester .22 uf 5% 50V		946-026745-224	
Capacitor	Metal Polyester .0022 uf 5% 50V		946-026745-222	
Capacitor	Metal Polyester .027 uf 5% 50V		946-026745-273	
Capacitor	Metal Polyester .02 uf 5% 50V		946-026745-203	
Capacitor	Metal Polyester .002 uf 5% 50V		946-026745-202	-
Capacitor	Metal Polyester .022 uf 5% 50V		946-026745-223	
Capacitor	Metal Polyester .0024 uf 5% 50V		946-026745-242	
Capacitor	Metal Polyester .039 uf 5% 50V		946-026745-393	•
Capacitor	Metal Polyester .0033 uf 5% 50V		946-026745-332	
Capacitor	Metal Polyester .033 uf 5% 50V		946-026745-333	
Capacitor	Metal Polyester .047 uf 5% 50V		946-026745-473	
Capacitor	Metal Polyester .0047 uf 5% 50V		946-026745-472	
Capacitor	Metal Polyester .015 uf 5% 50V		946-026745-513	
Capacitor	Metal Polyester .056 uf 5% 50V		946-026745-563	
Capacitor	Metal Polyester .068 uf 5% 50V		946-026745-683	

PARTS LIST

Part	Description	Schematic Reference	Part Number
UPPER FLUTE & SYMPHONIC STRING FILTER BOARD ASSEMBLY (Continued)			
Capacitor	Metal Polyester .0068 uf 5% 50V.		946-026745-682
Capacitor	Metal Polyester .075 uf 5% 50V.		946-026745-753
Capacitor	Metal Polyester .0082 uf 5% 50V.		946-026745-822
Capacitor	Metal Polyester .014 uf 5% 50V.		946-026745-143
Capacitor	Metal Polyester .0056 uf 5% 50V.		946-026745-562
Capacitor	Polystyrene .22 uf 10% 50V.		946-026037-224
Capacitor	Polystyrene .1 uf 10% 50V.		946-026037-104
Capacitor	Polystyrene .068 uf 10% 50V.		946-026037-683
Capacitor	Polystyrene .047 uf 10% 50V.		946-026037-473
Capacitor	Polystyrene .0047 uf 10% 50V.		946-026037-472
Capacitor	Polystyrene .0082 uf 10% 50V.		946-026037-822
Capacitor	Polystyrene .01 uf 10% 50V.		946-026037-103
Capacitor	Polystyrene .022 uf 10% 50V.		946-026037-223
Capacitor	Polystyrene .0039 uf 10% 50V.		946-026037-392
Capacitor	Polystyrene .039 uf 10% 50V.		946-026037-393
Capacitor	Polystyrene .0047 uf 10% 50V.		946-026037-472
Capacitor	Polystyrene .047 uf 10% 50V.		946-026037-473
Capacitor	Polystyrene .0068 uf 10% 50V.		946-026037-682
Capacitor	Tantalum 5.6 uf 25V.		946-021452-001
Diode		All	919-024769
IC	Quad Op-Amp	IC25-34	991-024103
IC	Quad Op-Amp	IC35, 36	991-025267
Network	Reed String		949-024537
Photocell		PI	948-022782
Socket	14-Pin		906-018905
Transistor	FET Audio Switch	IC70-77,116-118	991-022774
UPPER KEYING CONTROL & AOC BOARD ASSEMBLY			
Capacitor	Electrolytic 40 uf 25V Dual		945-022781-001
Diode		All	919-024769
Potentiometer	5K 20% AOC Range Adjustment	VR33	925-004349-005
Transistor	NPN AOC Range Regulator	Q242	991-020425-001
Transistor	PNP Driver Enable	Q243	991-020426-003
Transistor	NPN Golden Harp Enable Switcher	Q244	991-002232
Transistor	NPN	Q245,247,249,251,253, 255,257,259,261,263, 265,267	991-008393
Transistor	PNP	All others	991-010098
UPPER/LOWER KEYSWITCH ASSEMBLY			
Actuator	Keyswitch		964-024116
Coil	70 uh	L3,6,7,10,16,17	956-018877
Diode		All	919-024769
Spring	Pulldown		975-007085

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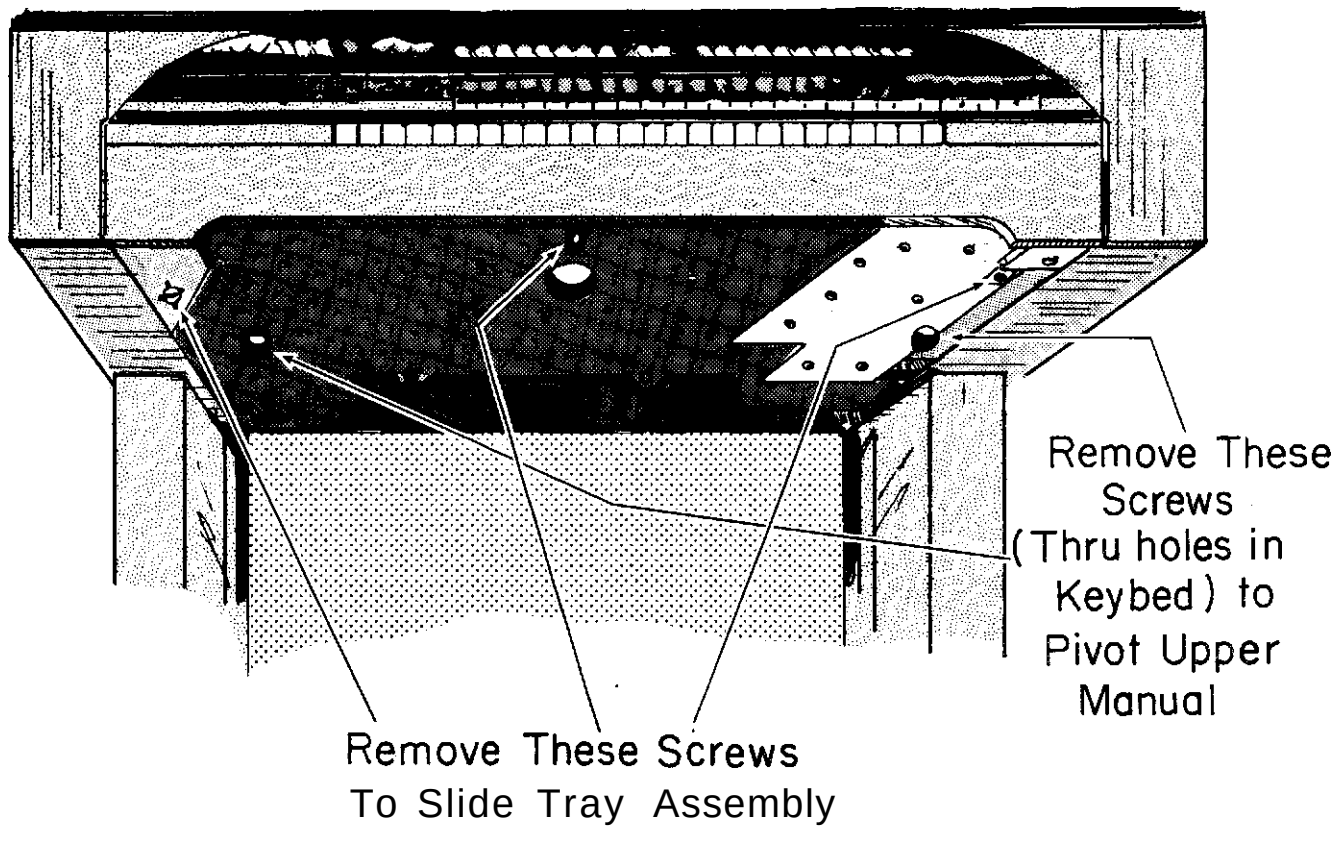
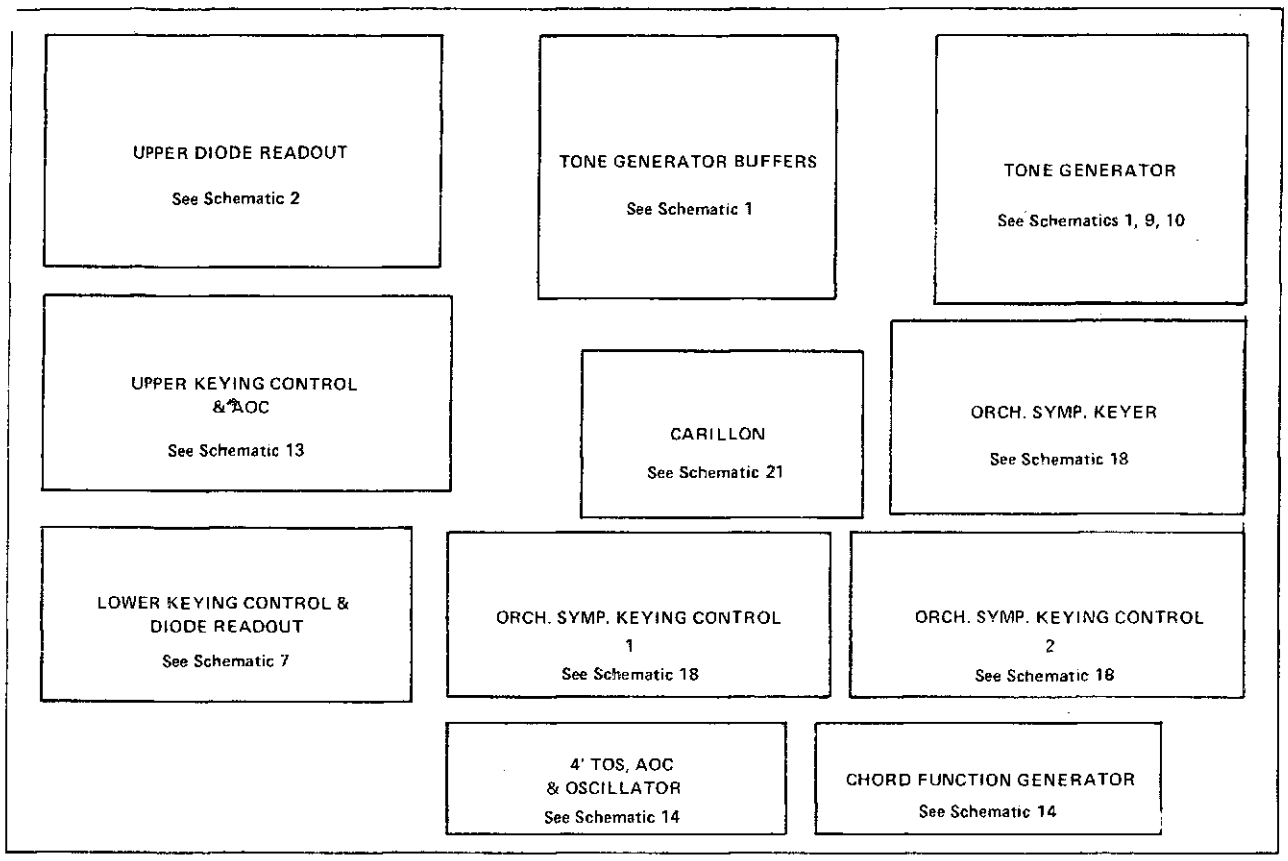
Power Supply Chassis (Bottom View) **51**

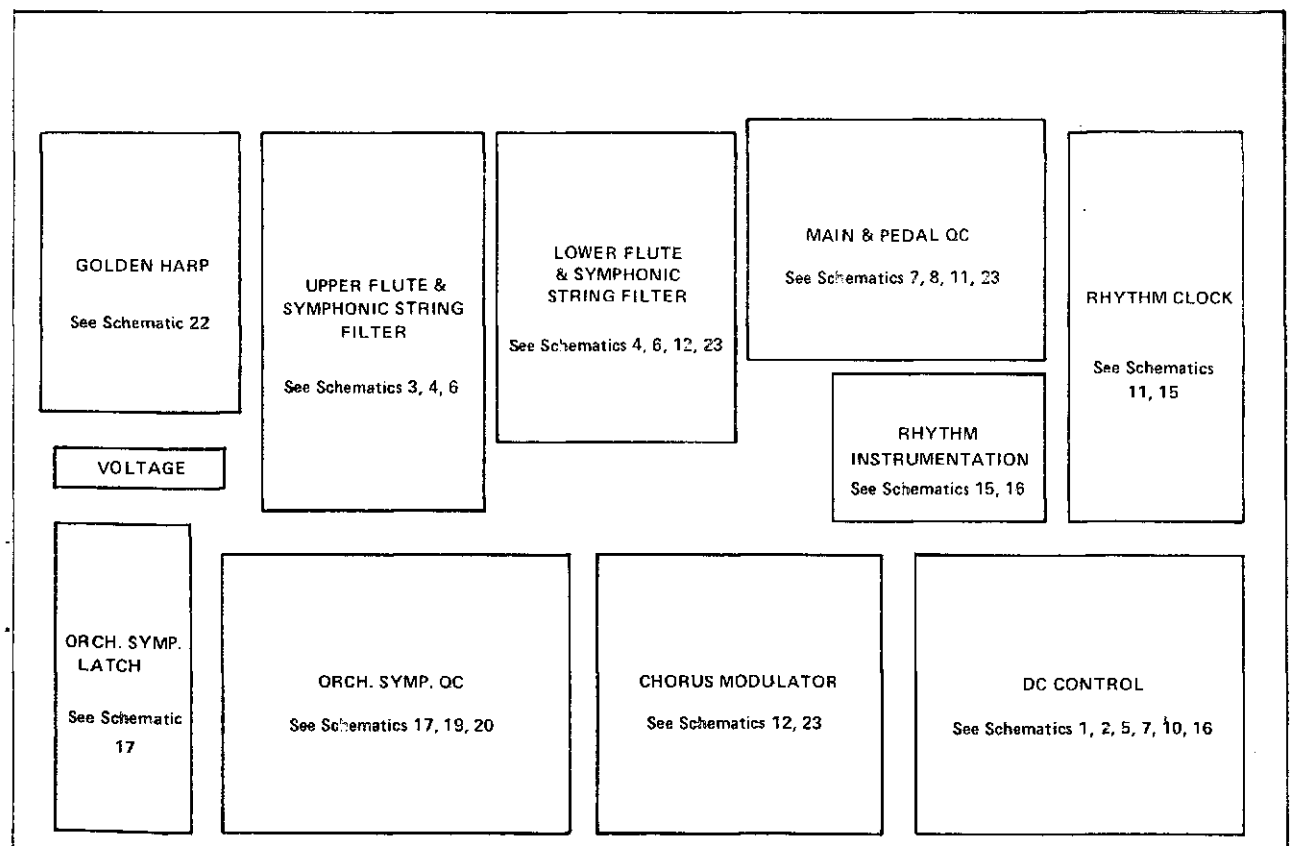
IMPORTANT! Before Printed Circuit Board Trays can be Lowered or Upper Manual can be Pivoted Upward Tray Assembly must be Slid Back

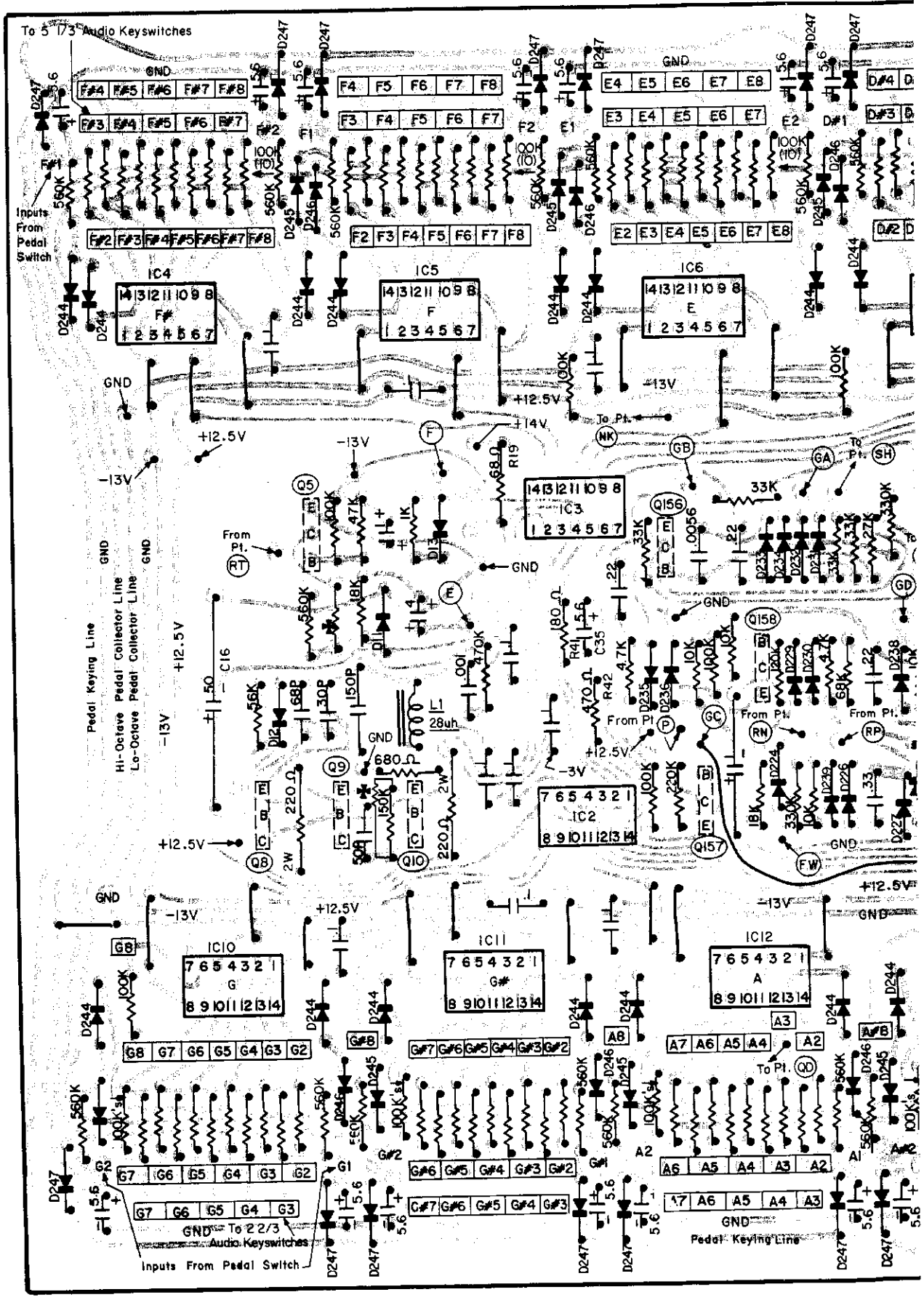


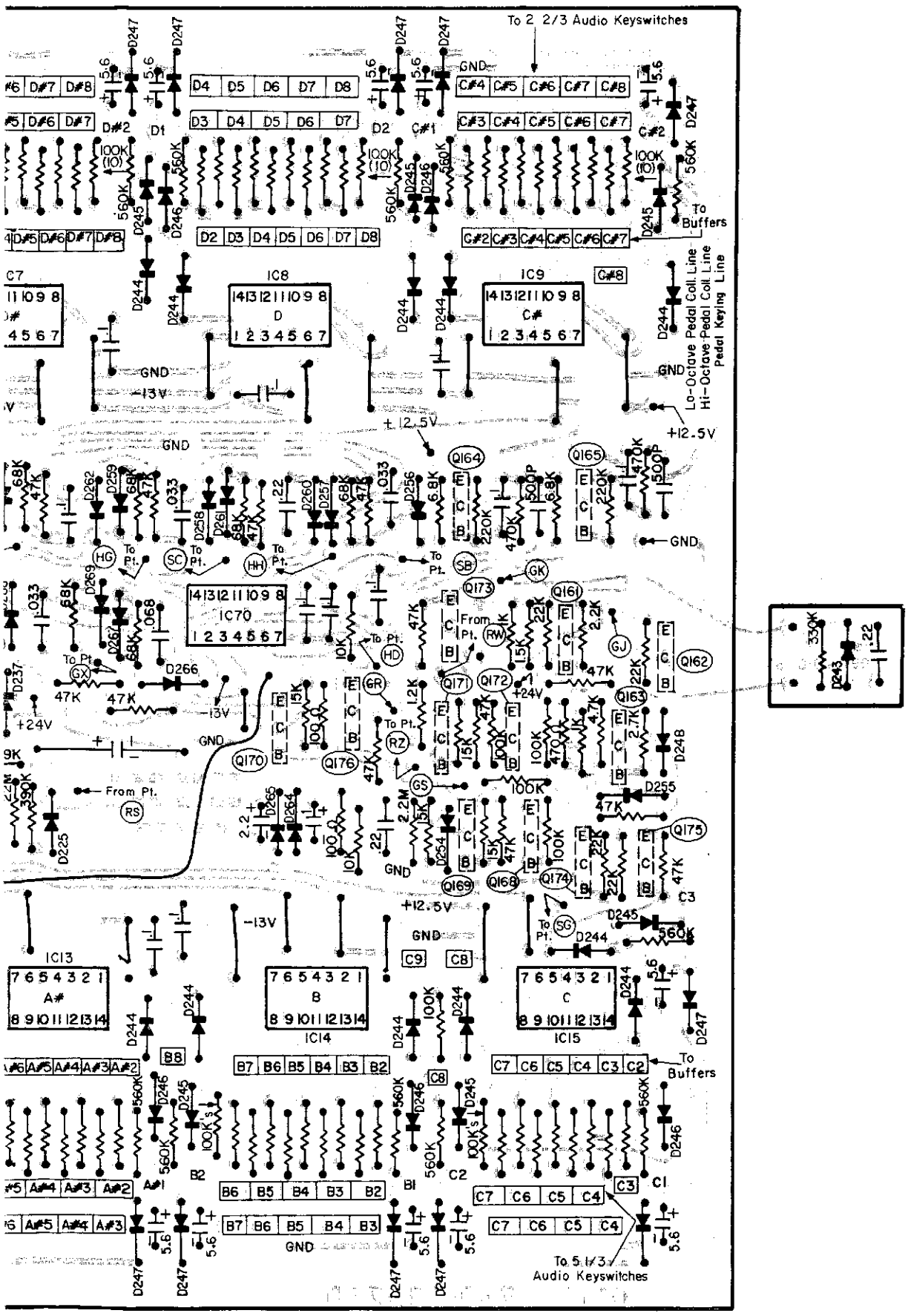


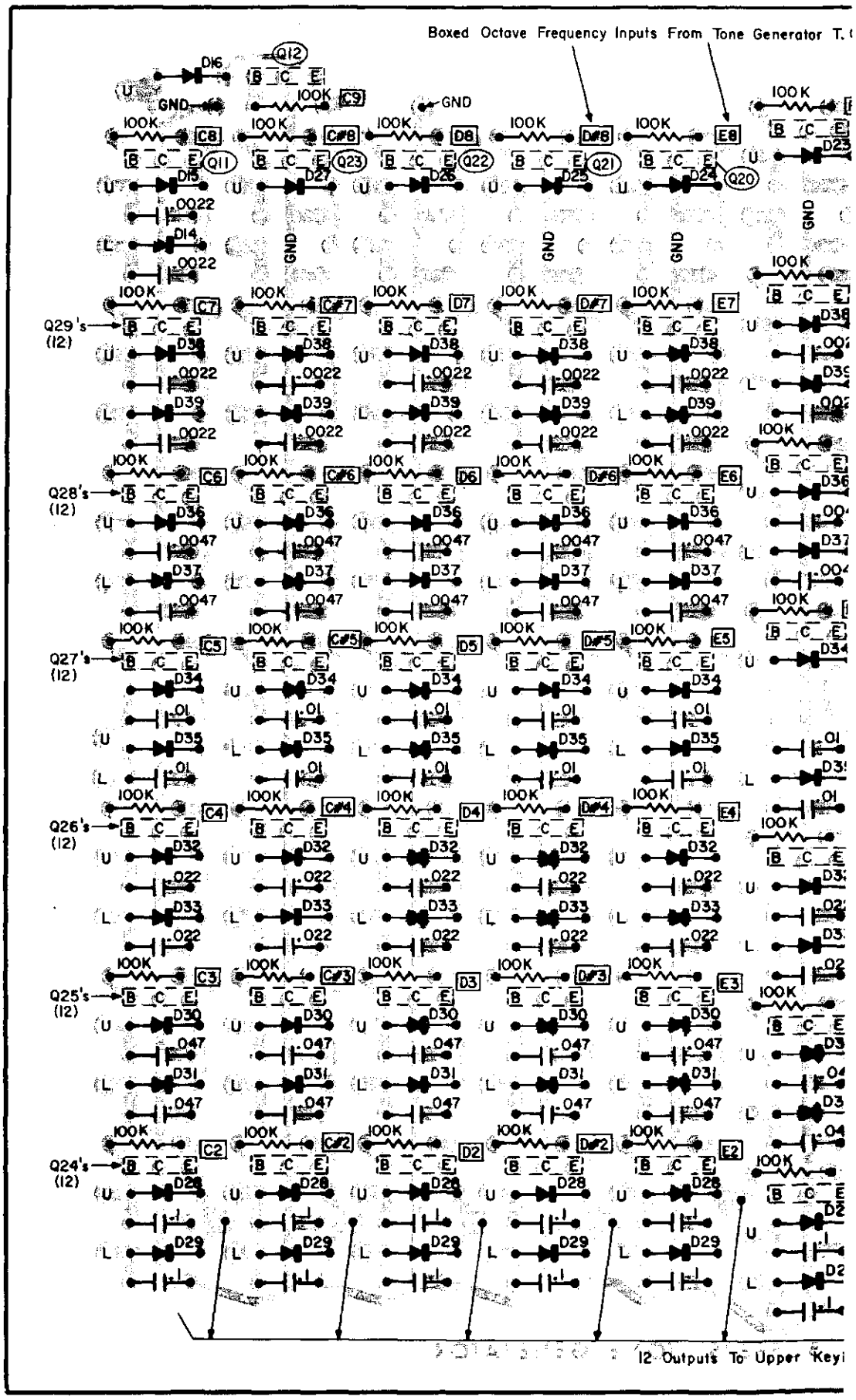
TRAY UP

TRAY DOWN

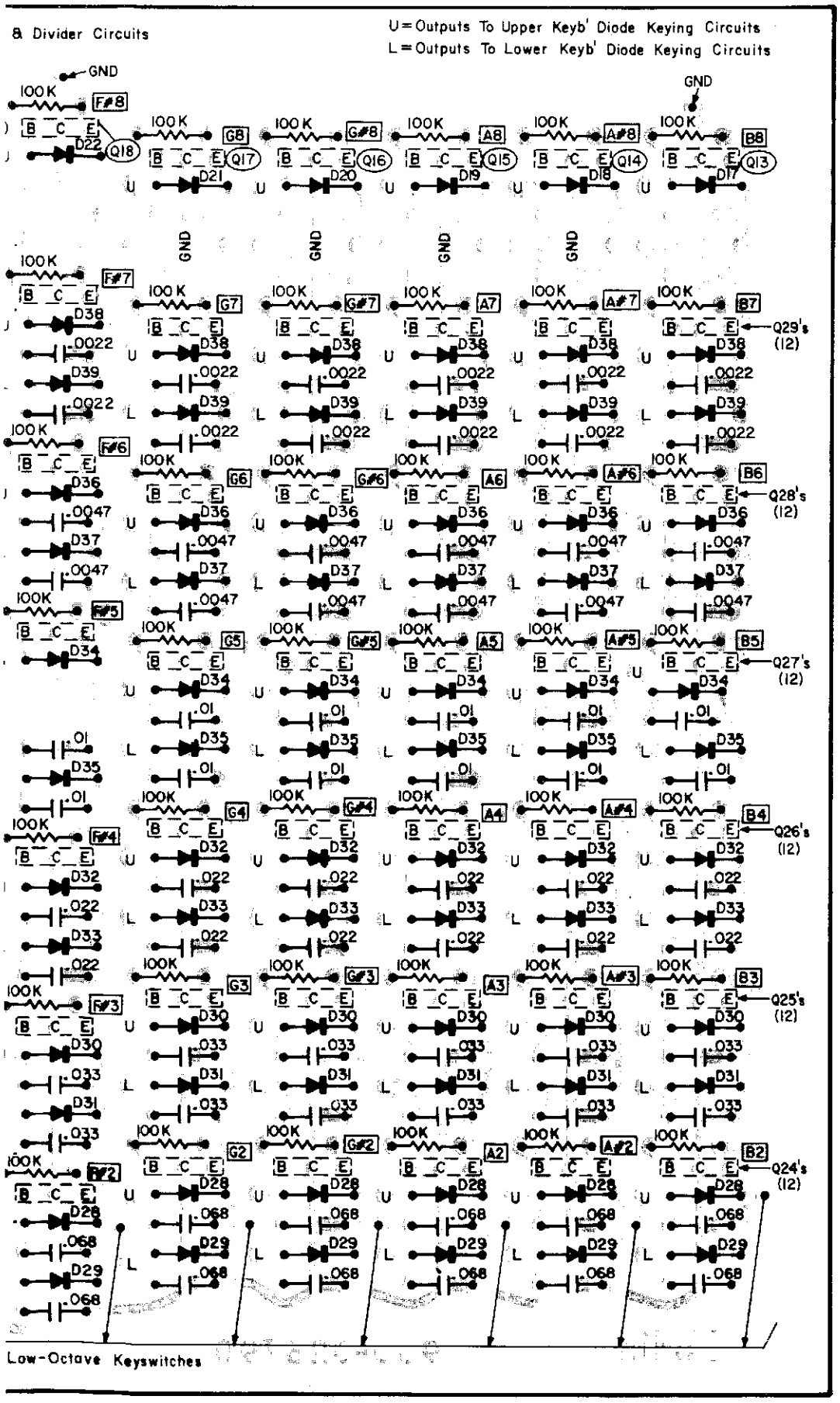



To 5 1/3 Audio Keyswitches
GND
F#4 F#5 F#6 F#7 F#8
F#3 F#4 F#5 F#6 F#7
F#2 F#3 F#4 F#5 F#6 F#7 F#8
F4 F5 F6 F7 F8
F3 F4 F5 F6 F7
F2 F3 F4 F5 F6 F7 F8
E4 E5 E6 E7 E8
E3 E4 E5 E6 E7
E2 E3 E4 E5 E6 E7 E8
D#4
D#3
D#2
D247
D246
D245
D244
5.6
100K
560K
IC4
IC5
IC6
IC3
IC2
IC10
IC11
IC12
F#
F
E
G
G#
A
+12.5V
-13V
+14V
GND
To Pt.
From Pt.
Inputs From Pedal Switch
Pedal Keying Line
Hi-Octave Pedal Collector Line
Lo-Octave Pedal Collector Line
GB
GA
SH
NK
RT
GC
RN
RP
FW
GD
Q5
Q8
Q9
Q10
Q156
Q157
Q158
R19
R41
R42
C16
C35
28uh
33K
680Ω
220Ω
150K
470K
4.7K
10K
18K
56K
68K
330K
220K
G8 G7 G6 G5 G4 G3 G2
G#8 G#7 G#6 G#5 G#4 G#3 G#2
A8 A7 A6 A5 A4 A3 A2 A1
GND To 2 2/3 Audio Keyswitches
Inputs From Pedal Switch
Pedal Keying Line

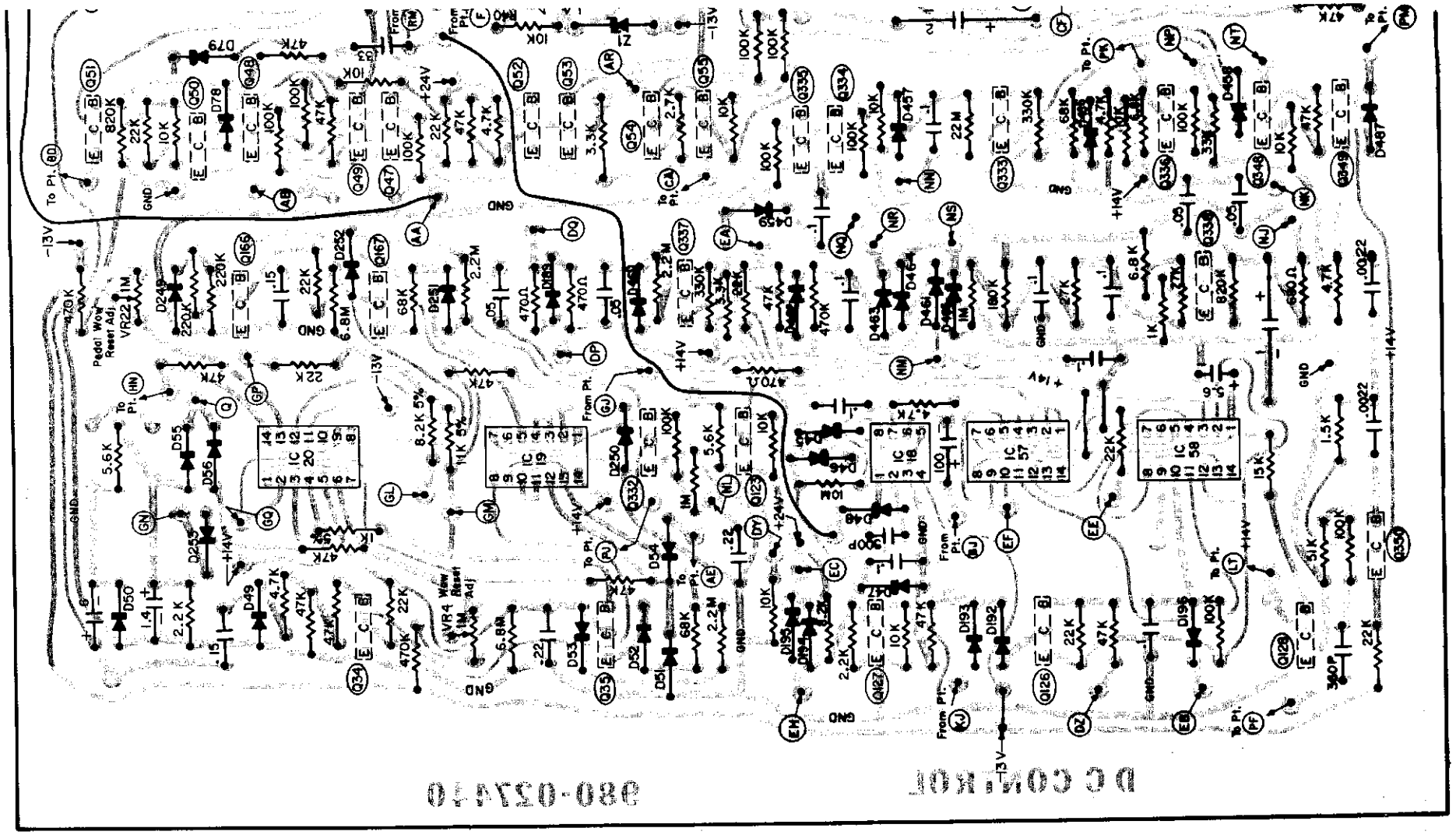

To 2 2/3 Audio Keyswitches
GND
To Buffers
Lo-Octave Pedal Coil Line
Hi-Octave Pedal Coil Line
Pedal Keying Line
IC7
IC8
IC9
IC13
IC14
IC15
IC70
+12.5V
-13V
+24V
From Pt.
To Pt.
To Buffers
To 5 1/3 Audio Keyswitches


Boxed Octave Frequency Inputs From Tone Generator T.
GND
100K
C8
C#8
D8
D#8
E8
C7
C#7
D7
D#7
E7
C6
C#6
D6
D#6
E6
C5
C#5
D5
D#5
E5
C4
C#4
D4
D#4
E4
C3
C#3
D3
D#3
E3
C2
C#2
D2
D#2
E2
Q11
Q12
Q20
Q21
Q22
Q23
Q24's (12)
Q25's (12)
Q26's (12)
Q27's (12)
Q28's (12)
Q29's (12)
D14
D15
D16
D23
D24
D25
D26
D27
D28
D29
D30
D31
D32
D33
D34
D35
D36
D37
D38
D39
.0022
.0047
.01
.022
.047
U
L
12 Outputs To Upper Keyi

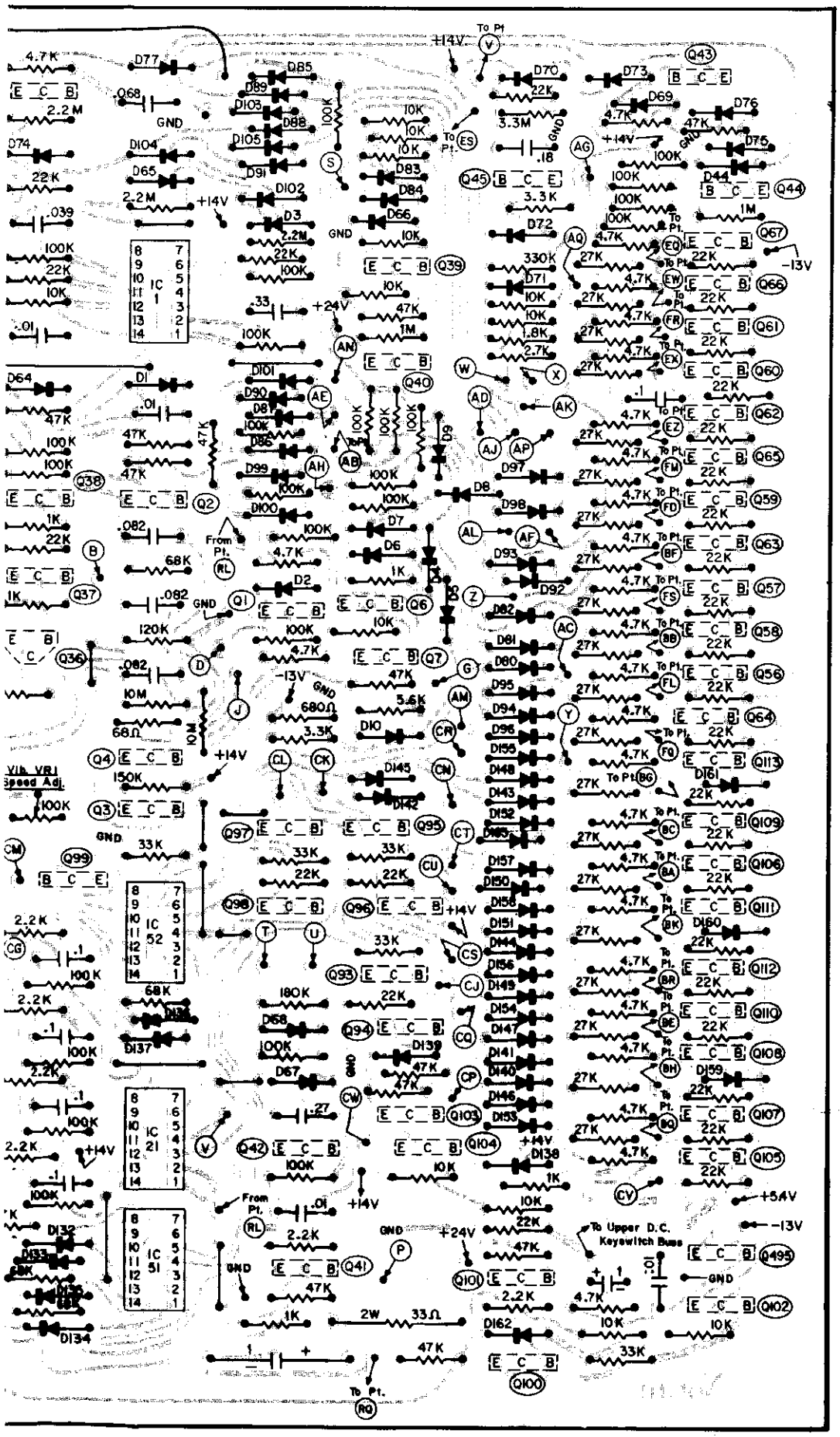
BUFFER BOARD



D. C.



CONTROL BD.


+14V
To P1
D77
D85
D89
D103
D88
D105
D91
D102
D3
D66
D83
D84
D70
22K
3.3M
.18
GND
To P1
(ES)
(V)
D73
(Q43)
D69
D76
47K
4.7K
+14V
100K
D75
D44
(Q44)
(AG)
(Q45)
3.3K
D72
330K
D71
10K
1.8K
2.7K
(AQ)
(W)
(X)
(AD)
(AK)
(AJ)
(AP)
D97
D8
D98
(AL)
(AF)
D93
D92
D82
D81
D80
D95
D94
D96
D155
D148
D143
D132
D85
D157
D150
D156
D151
D144
D156
D149
D154
D147
D141
D140
D146
D153
D138
1K
22K
47K
(Z)
(AC)
(Y)
(G)
(AM)
(CR)
(CN)
(CT)
(CU)
(CS)
(CJ)
(CQ)
(CP)
(CW)
(Q103)
(Q104)
(CV)
+5.4V
-13V
To Upper D.C. Keyswitch Buss
(Q495)
(Q102)
(Q100)
(Q101)
(P)
(Q41)
(RQ)
To Pt.
(Q67)
-13V
(EQ)
(EW)
(FR)
(EX)
(EZ)
(FM)
(FD)
(BF)
(FS)
(BB)
(FL)
(Q64)
(FQ)
(BG)
D161
(BC)
(8A)
(BK)
D160
(BR)
(8E)
(8H)
D159
(8Q)
(Q109)
(Q106)
(Q111)
(Q112)
(Q110)
(Q108)
(Q107)
(Q105)
(Q66)
(Q61)
(Q60)
(Q62)
(Q65)
(Q59)
(Q63)
(Q57)
(Q58)
(Q56)
(Q113)
IC 1
IC 52
IC 21
IC 51
D64
D1
.01
47K
100K
(Q38)
(Q2)
1K
22K
(B)
(Q37)
.082
68K
(Q1)
120K
(D)
(Q36)
10M
68Ω
(J)
(Q4)
150K
Vib. VR1 Speed Adj.
100K
(Q3)
GND
33K
(Q99)
2.2K
(CG)
.1
(Q98)
(T)
(U)
180K
D68
D67
.27
(Q42)
From Pt.
(RL)
(V)
(Q97)
(Q95)
(Q96)
(Q93)
(Q94)
D139
(Q40)
(AE)
(AH)
(AB)
D90
D8
D86
D99
D100
D7
D6
D2
(Q6)
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D66
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D142
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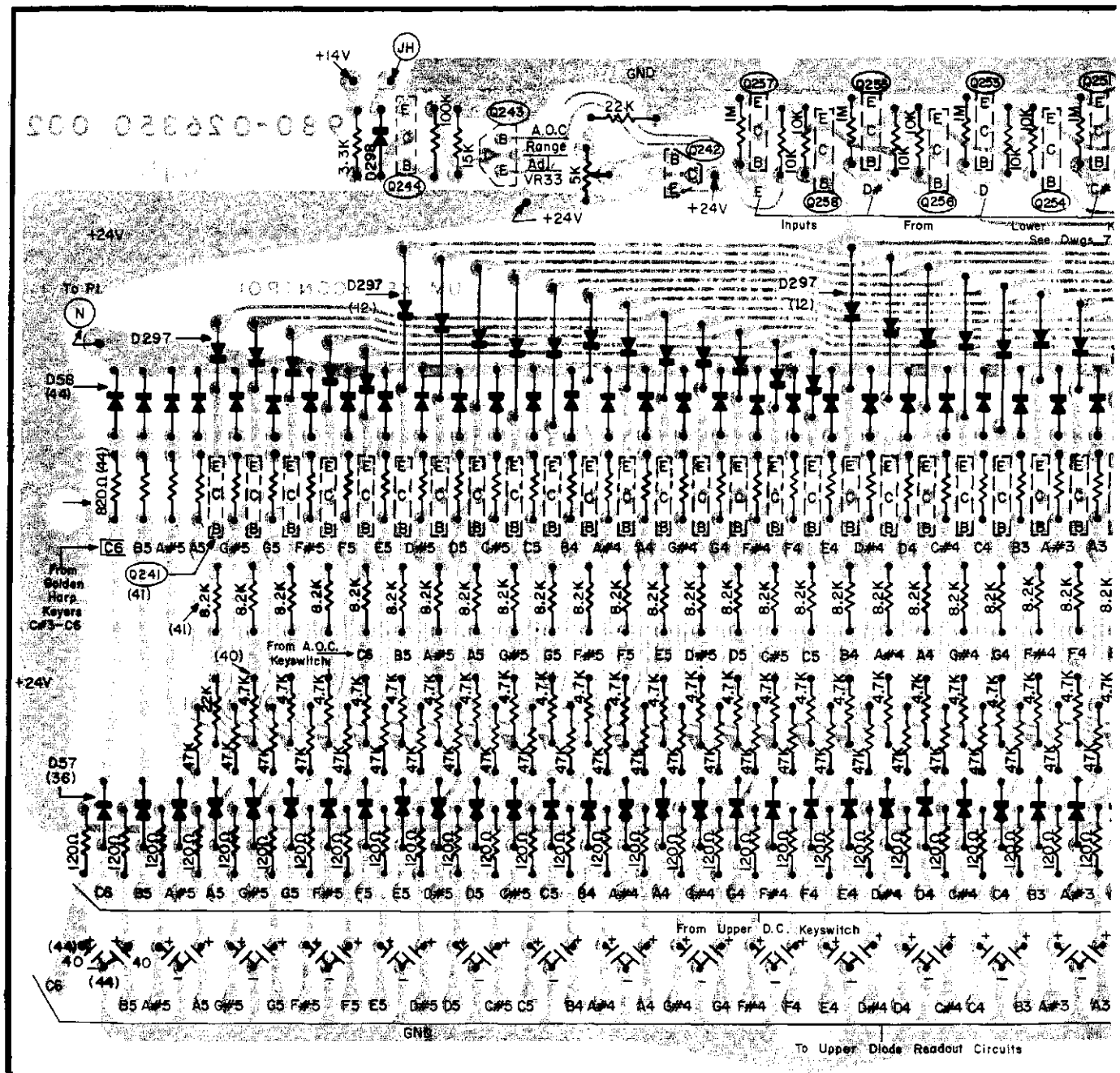
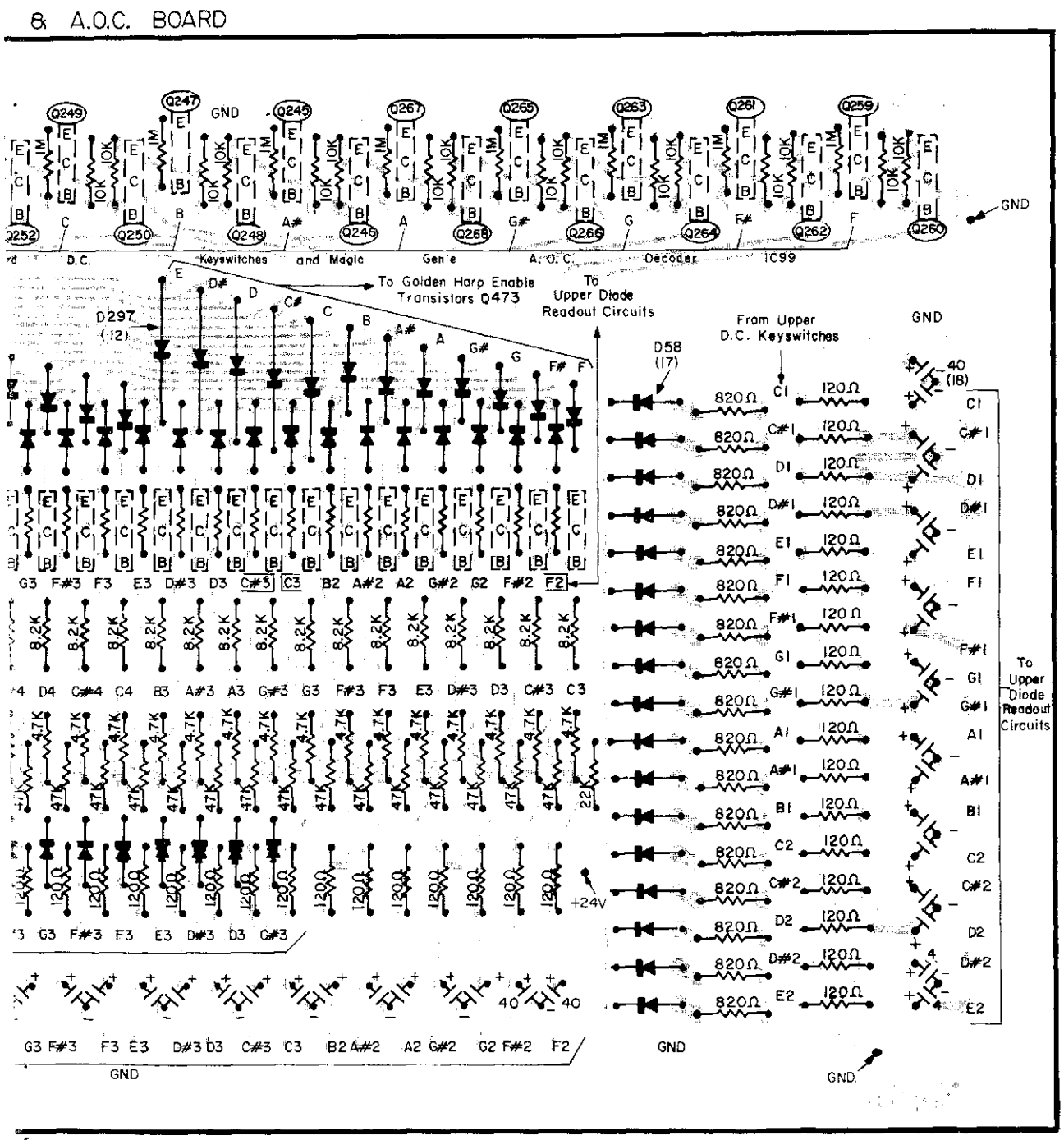
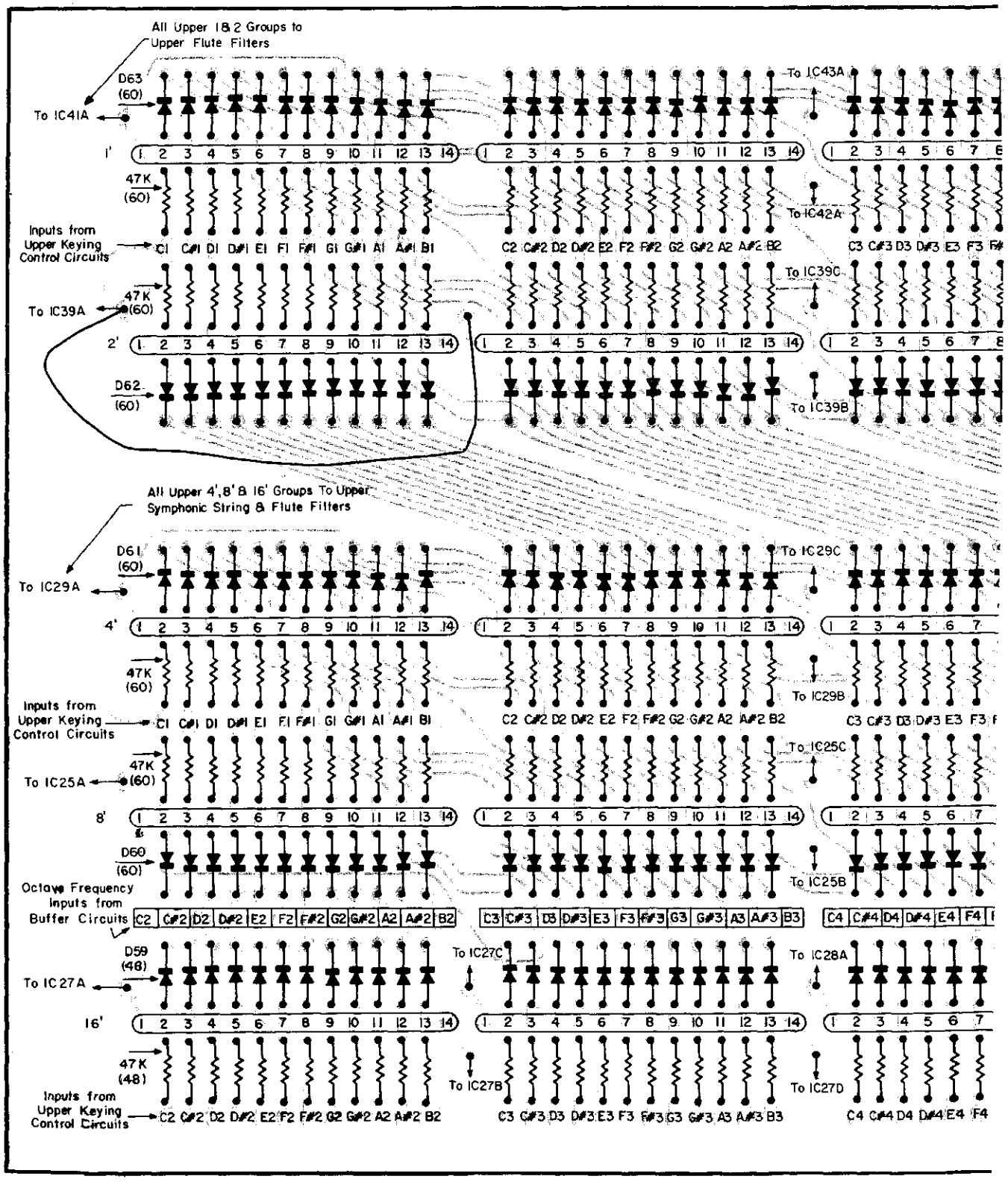
(ZZ)

UPPER KEYING CONTROL

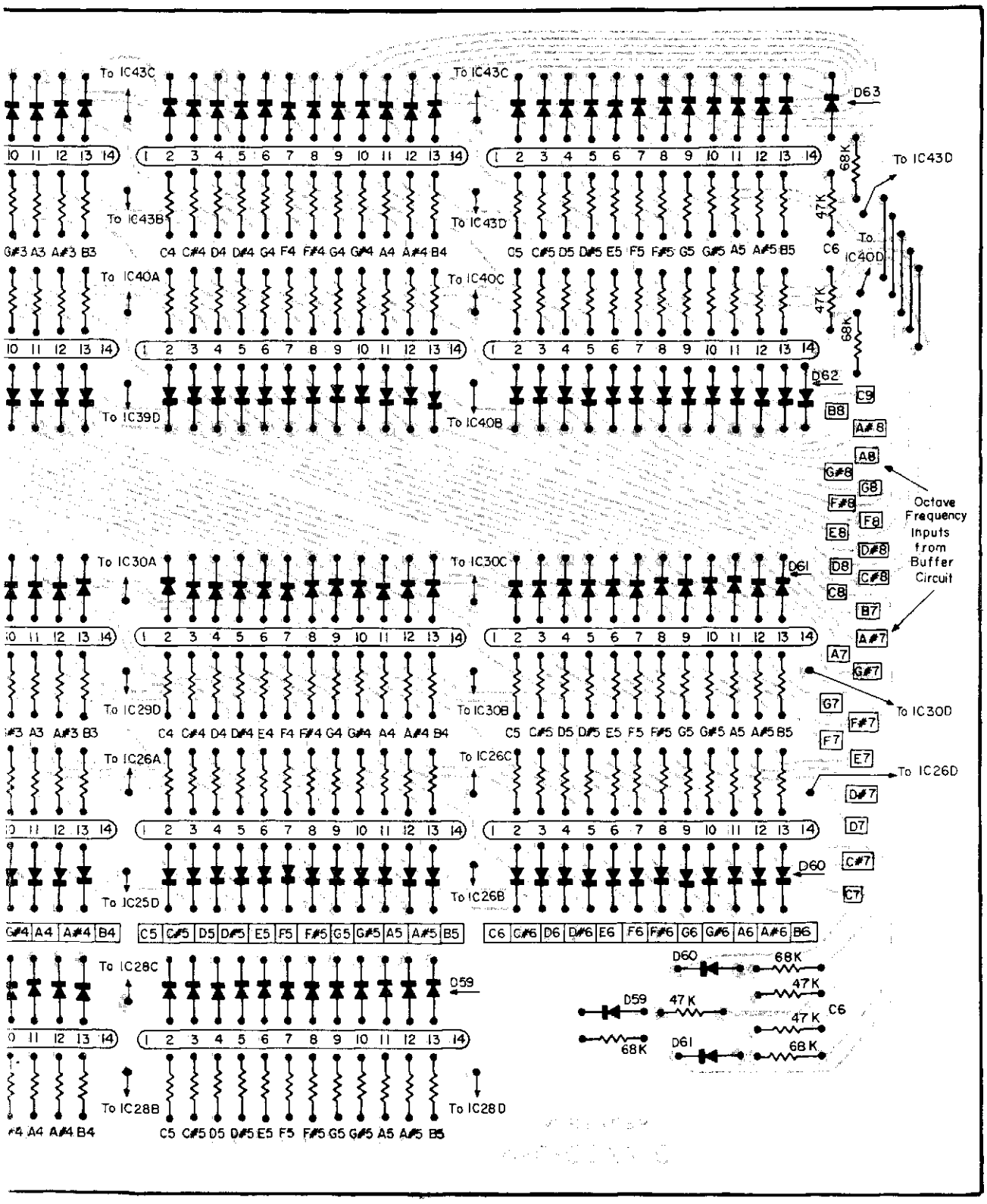


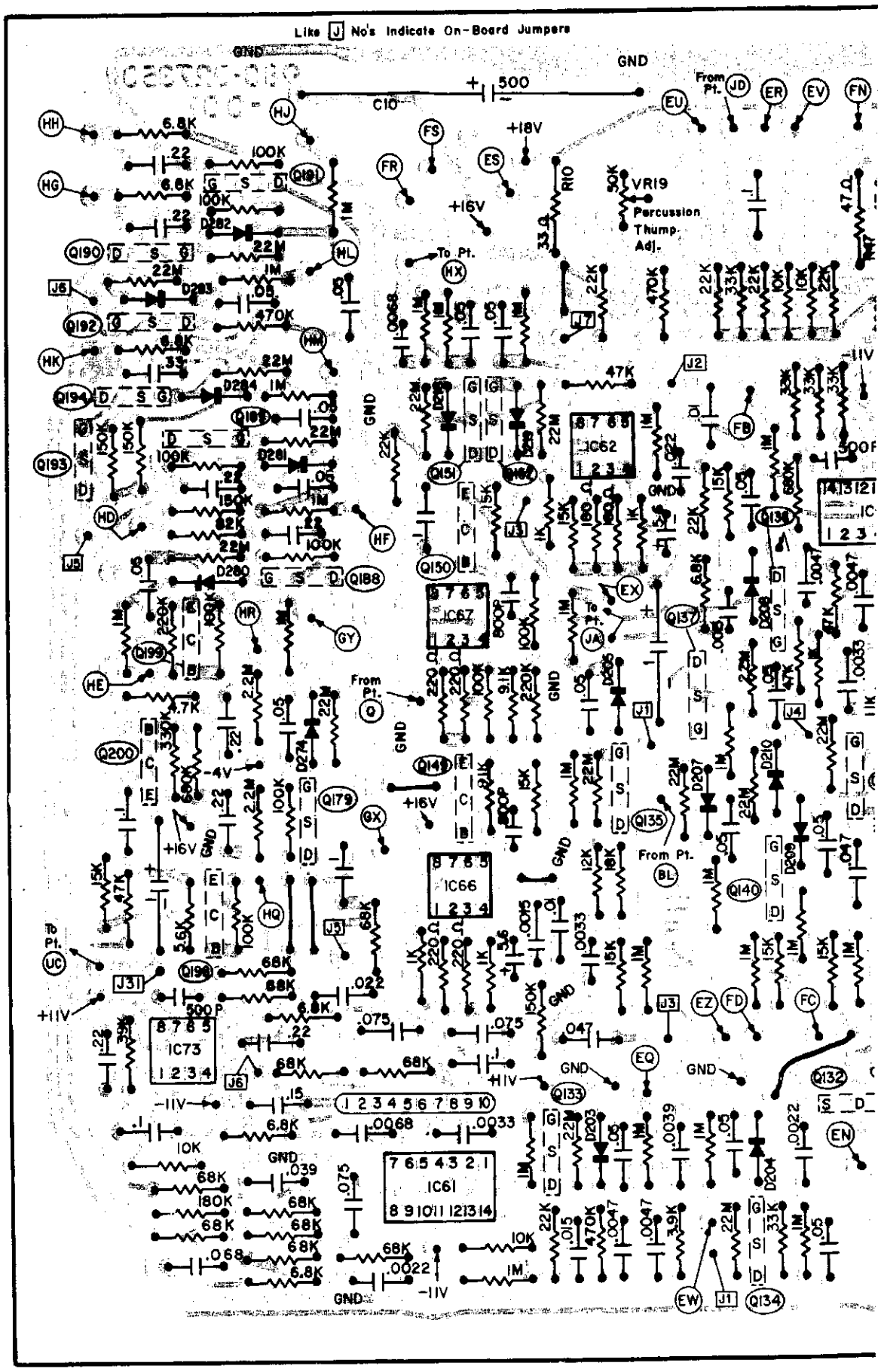
8 A.O.C. BOARD


Q249
Q247
GND
Q245
Q267
Q265
Q263
Q261
Q259
Q252
Q250
Q248
Q246
Q268
Q266
Q264
Q262
Q260
GND
D.C. Keyswitches and Magic Genie A.O.C. Decoder IC99
To Golden Harp Enable Transistors Q473
To Upper Diode Readout Circuits
From Upper D.C. Keyswitches
GND
D297 (12)
D58 (17)
40 (18)
820Ω
120Ω
8.2K
4.7K
22K
+24V
To Upper Diode Readout Circuits
GND
GND

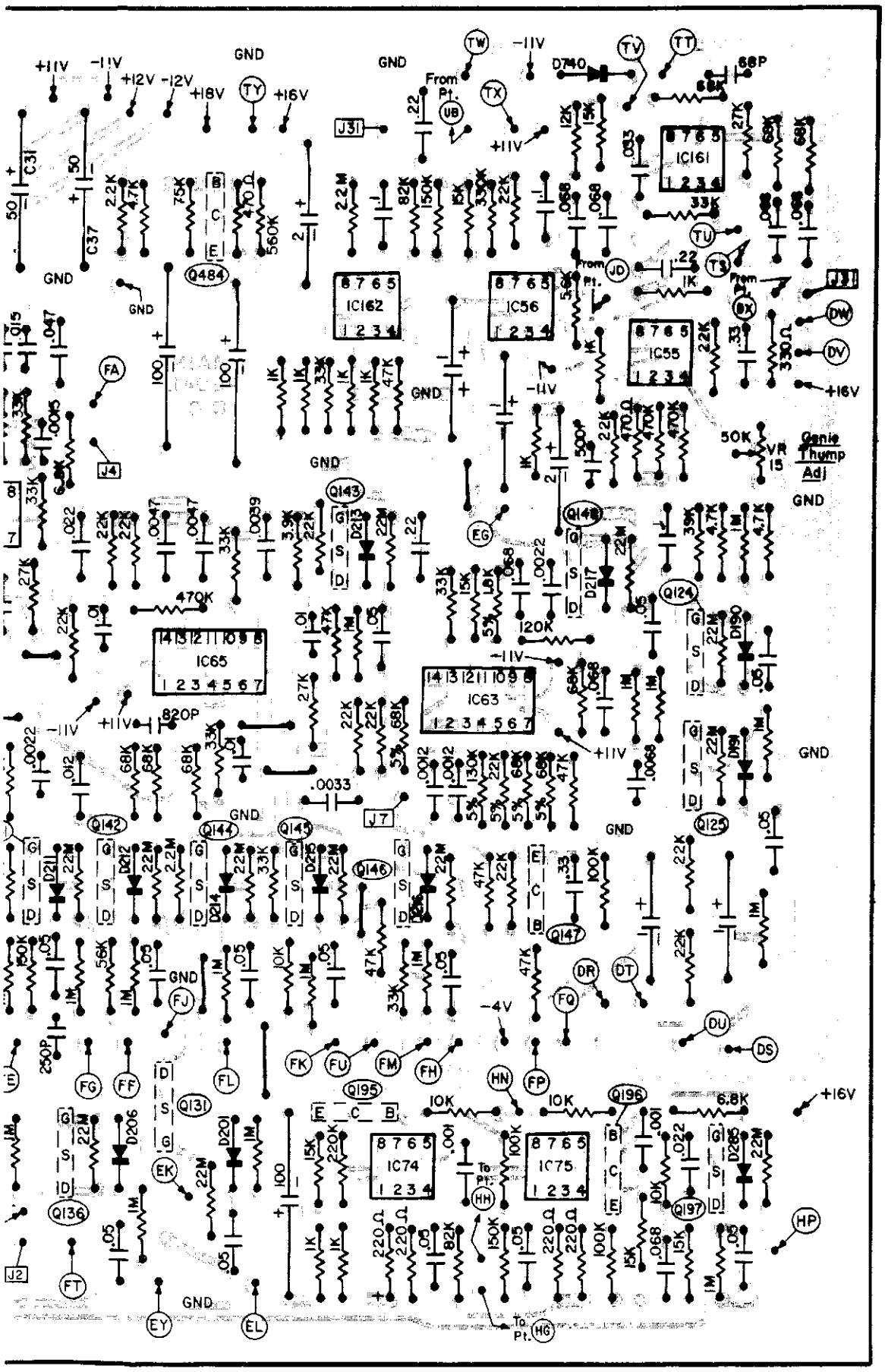

All Upper 1&2 Groups to Upper Flute Filters
D63 (60)
To IC41A
To IC43A
1'
47K (60)
To IC42A
Inputs from Upper Keying Control Circuits
C1 C#1 D1 D#1 E1 F1 F#1 G1 G#1 A1 A#1 B1
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2
C3 C#3 D3 D#3 E3 F3 F#
To IC39C
47K (60)
To IC39A
2'
D62 (60)
To IC39B
All Upper 4',8' & 16' Groups To Upper Symphonic String & Flute Filters
D61 (60)
To IC29A
To IC29C
4'
47K (60)
To IC29B
Inputs from Upper Keying Control Circuits
C1 C#1 D1 D#1 E1 F1 F#1 G1 G#1 A1 A#1 B1
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2
C3 C#3 D3 D#3 E3 F3
To IC25C
47K (60)
To IC25A
8'
D60 (60)
To IC25B
Octave Frequency Inputs from Buffer Circuits
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2
C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3
C4 C#4 D4 D#4 E4 F4
D59 (48)
To IC27A
To IC27C
To IC28A
16'
47K (48)
To IC27B
To IC27D
Inputs from Upper Keying Control Circuits
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2
C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3
C4 C#4 D4 D#4 E4 F4

READOUT BOARD




Like J No's Indicate On-Board Jumpers
GND
+500
C10
+18V
+16V
-4V
-11V
+11V
From Pt.
To Pt.
VR19
Percussion Thump Adj.
IC62
IC67
IC66
IC73
IC61
Q190
Q191
Q192
Q193
Q194
Q195
Q196
Q199
Q200
Q179
Q188
Q150
Q151
Q149
Q137
Q135
Q140
Q136
Q132
Q133
Q134
D282
D283
D284
D285
D280
D274
D207
D208
D209
D210
D203
D204
R10
J1
J2
J3
J4
J5
J6
J7
J31

Q. C. BOARD


+11V
-11V
+12V
-12V
+18V
+16V
GND
-4V
IC161
IC162
IC56
IC55
IC65
IC63
IC74
IC75
Genie Thump Adj
50K VR 15
D740
From Pt.
To Pt.
Q484
Q143
Q144
Q145
Q146
Q147
Q148
Q124
Q125
Q142
Q131
Q136
Q195
Q196
Q197
D211
D212
D213
D214
D215
D216
D217
D218
D219
D220
D221
D206
D208
D209
D210
J31
J4
J7
J2
TW
TX
TY
TV
TT
TU
TS
BX
DW
DV
DU
DS
DT
DR
FA
FG
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FJ
FT
EY
EL
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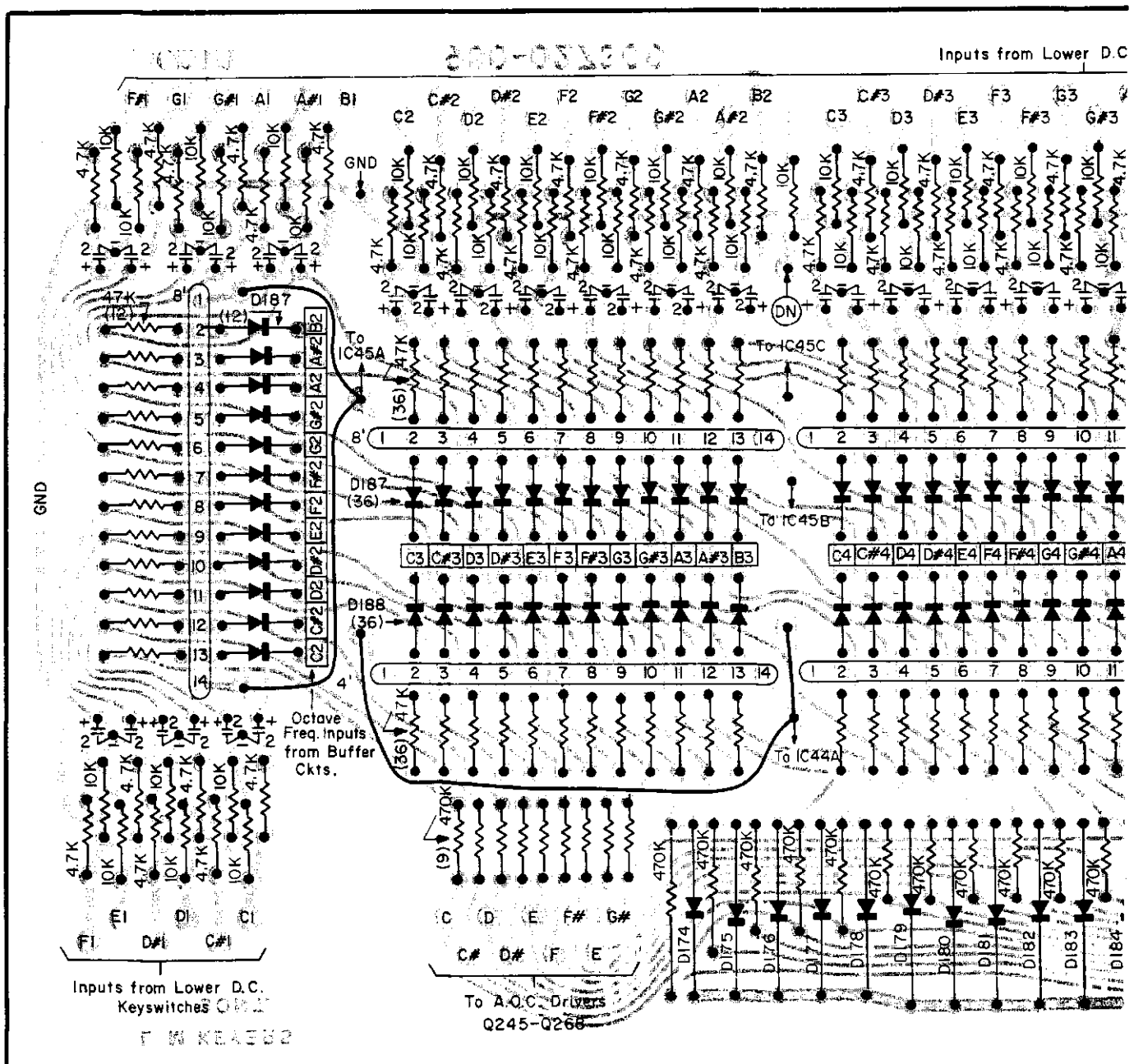
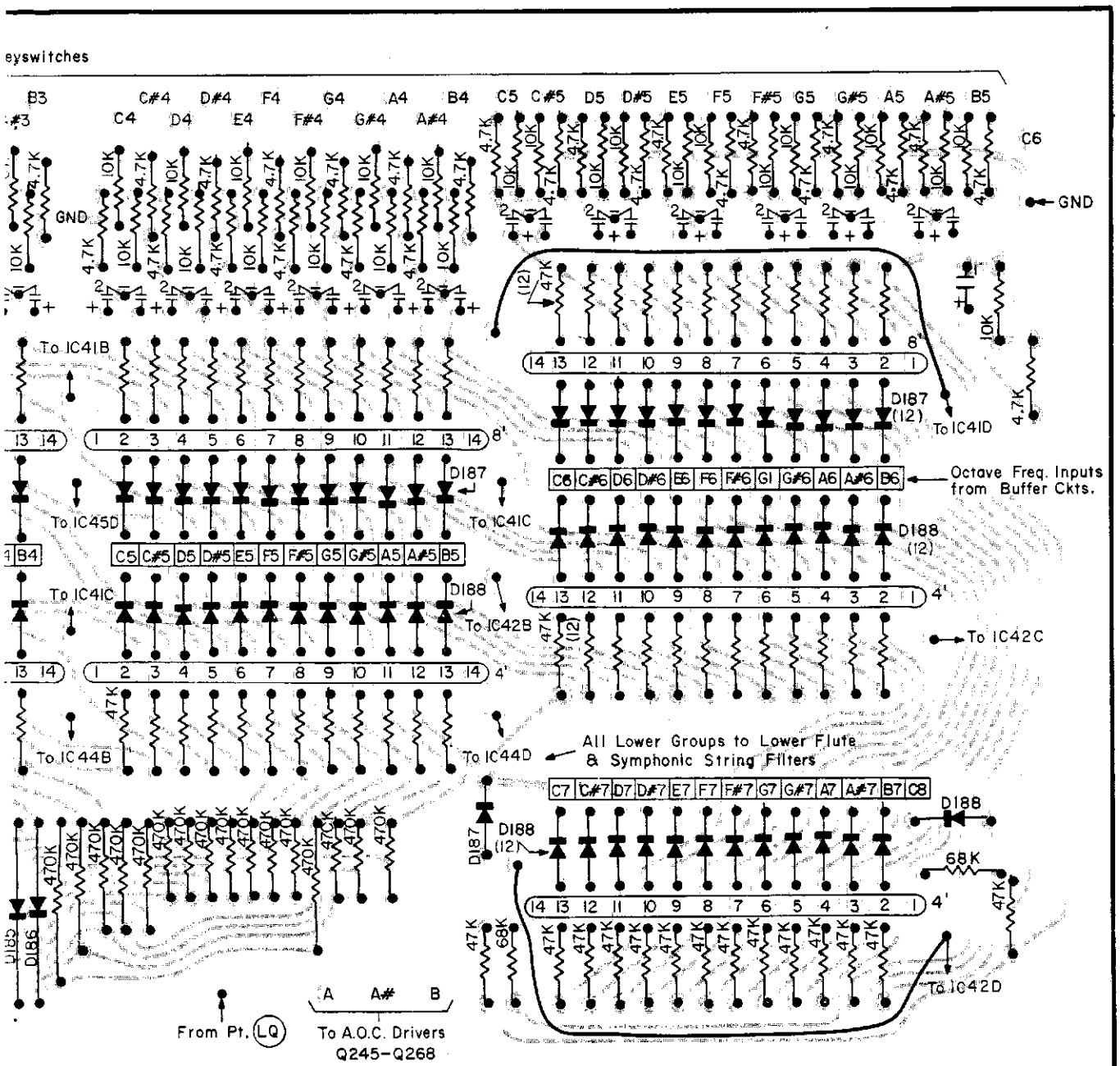
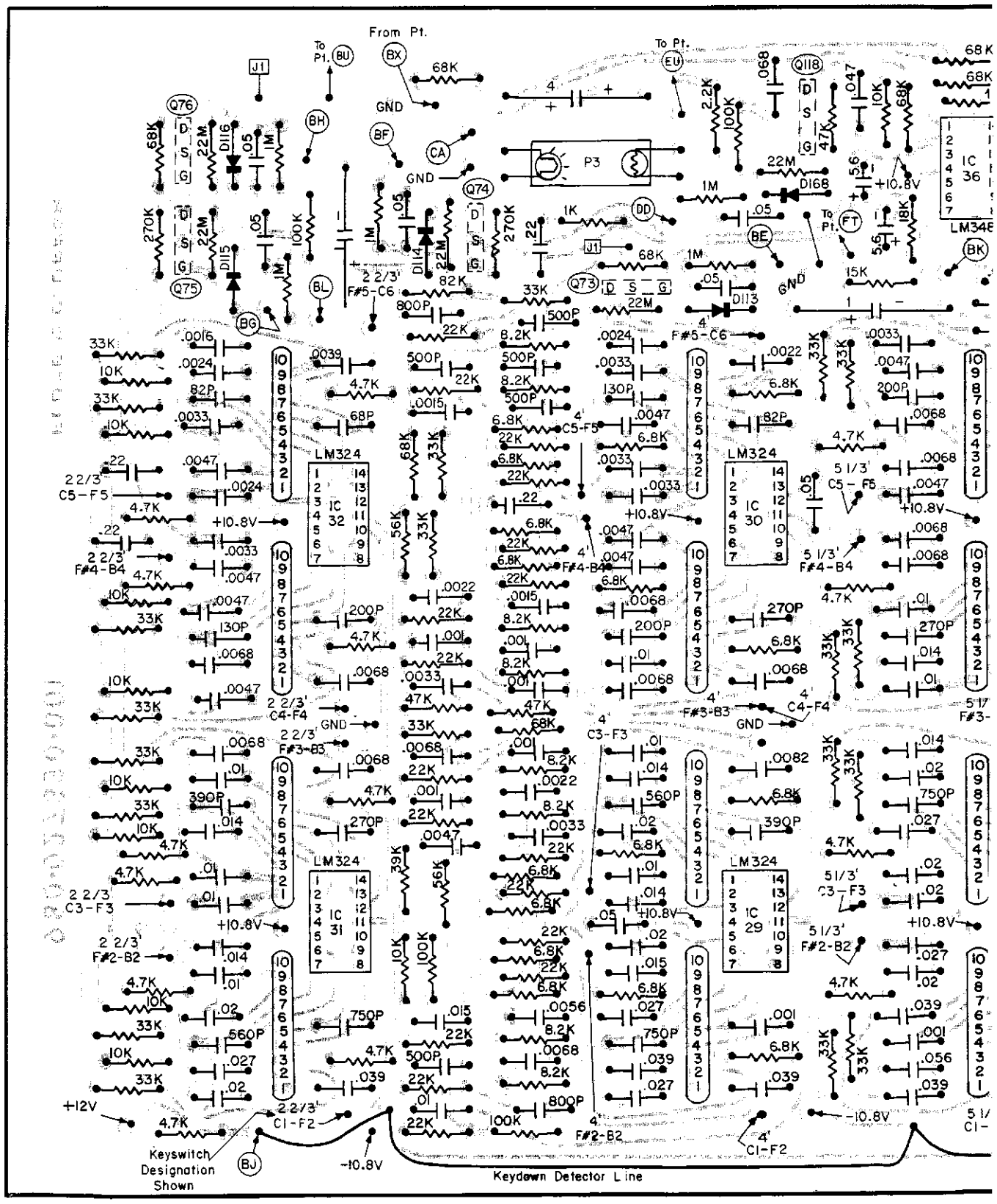
EG
HN
HH
HG
HP

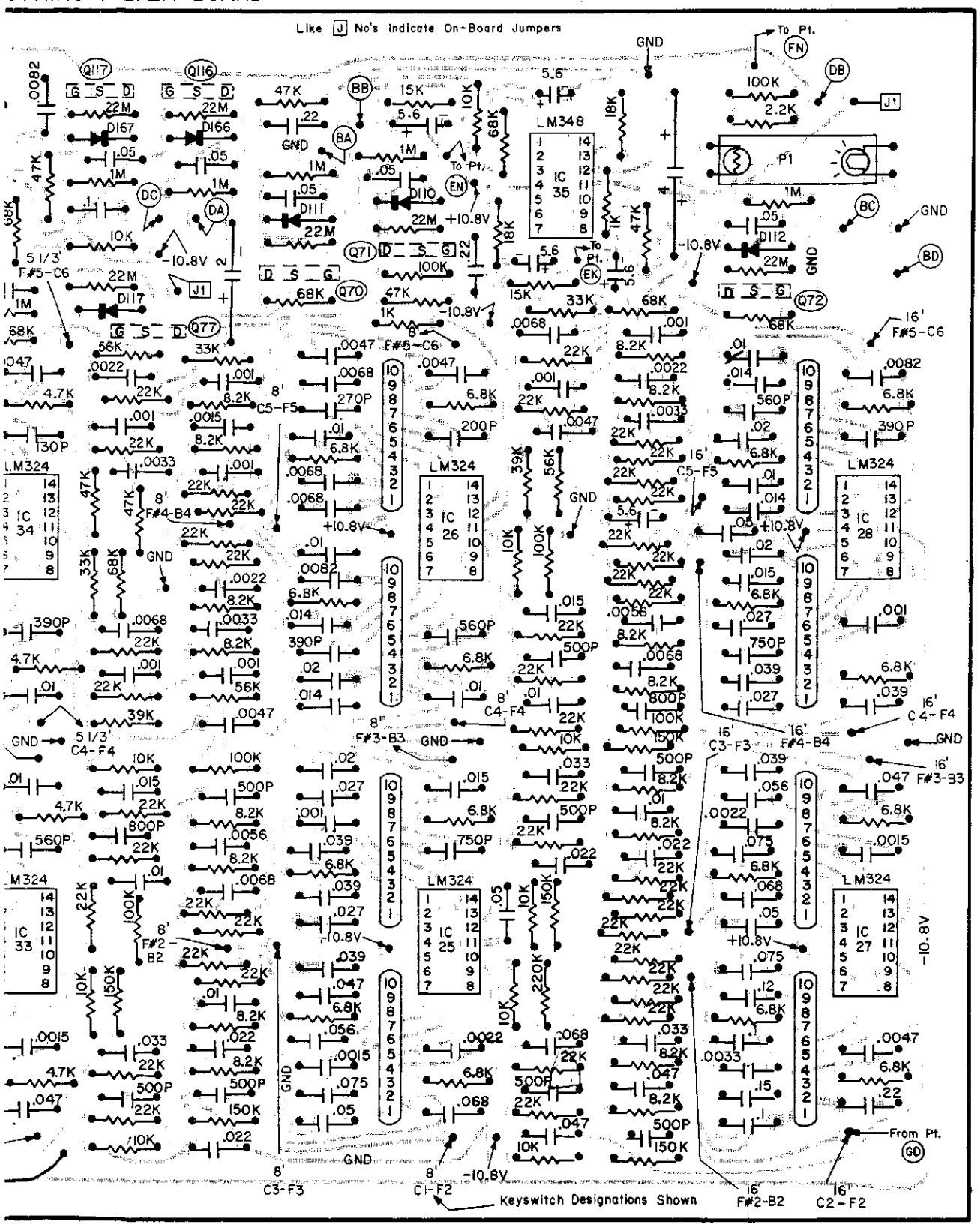

Inputs from Lower D.C
F#1 G1 G#1 A1 A#1 B1
C#2 D#2 F2 G2 A2 B2
C2 D2 E2 F#2 G#2 A#2
C#3 D#3 F3 G3
C3 D3 E3 F#3 G#3
GND
D187
D188
(36)
To IC45A
To IC45C
To IC45B
To IC44A
Octave Freq. Inputs from Buffer Ckts.
Inputs from Lower D.C. Keyswitches
To A.O.C. Drivers Q245-Q266
D174
D175
D176
D177
D178
D179
D180
D181
D182
D183
D184

DIODE READOUT BOARD

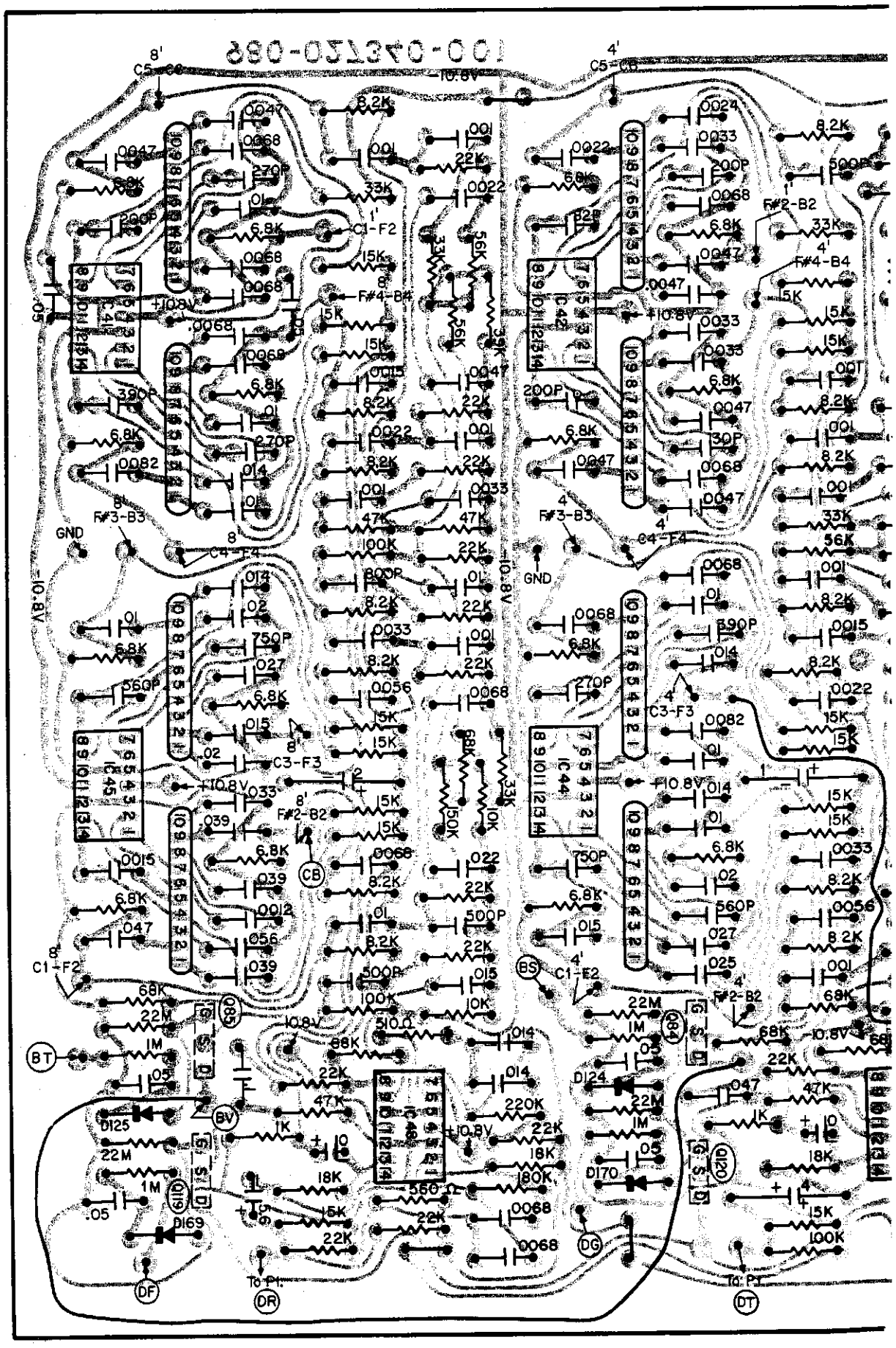



From Pt.
To Pt.
To Pt.
To Pt.
GND
P3
LM324
IC 32
IC 31
IC 30
IC 29
IC 36
LM348
+10.8V
-10.8V
+12V
2 2/3' F#5-C6
4' F#5-C6
4' C5-F5
2 2/3' C5-F5
5 1/3' C5-F5
2 2/3' F#4-B4
4' F#4-B4
5 1/3' F#4-B4
2 2/3' C4-F4
4' C4-F4
2 2/3' F#3-B3
4' F#3-B3
5 1/3' F#3-
2 2/3' C3-F3
4' C3-F3
5 1/3' C3-F3
2 2/3' F#2-B2
4' F#2-B2
5 1/3' F#2-B2
2 2/3' C1-F2
4' C1-F2
5 1/
C1-
Keyswitch Designation Shown
Keydown Detector Line

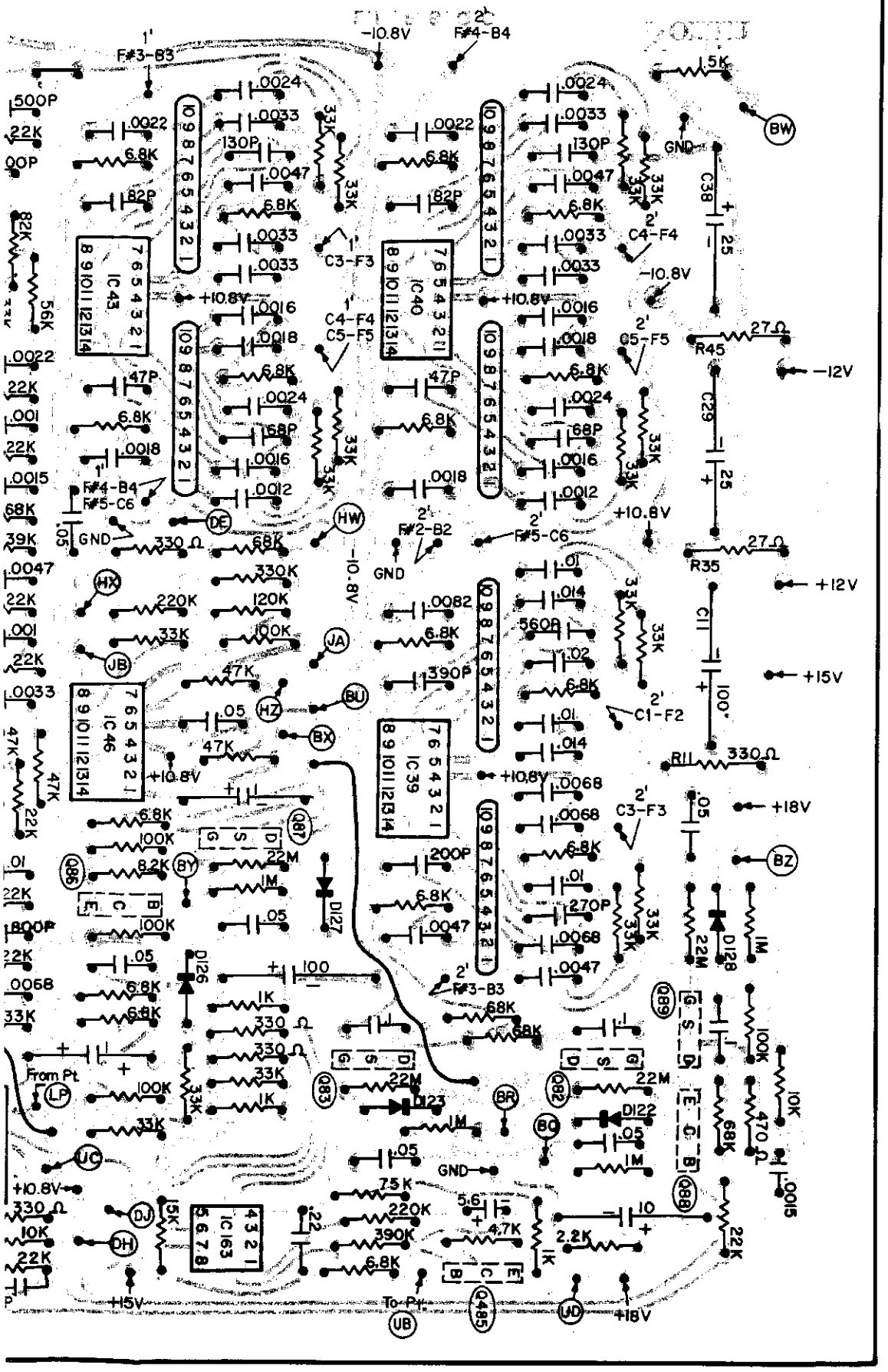
STRING FILTER BOARD

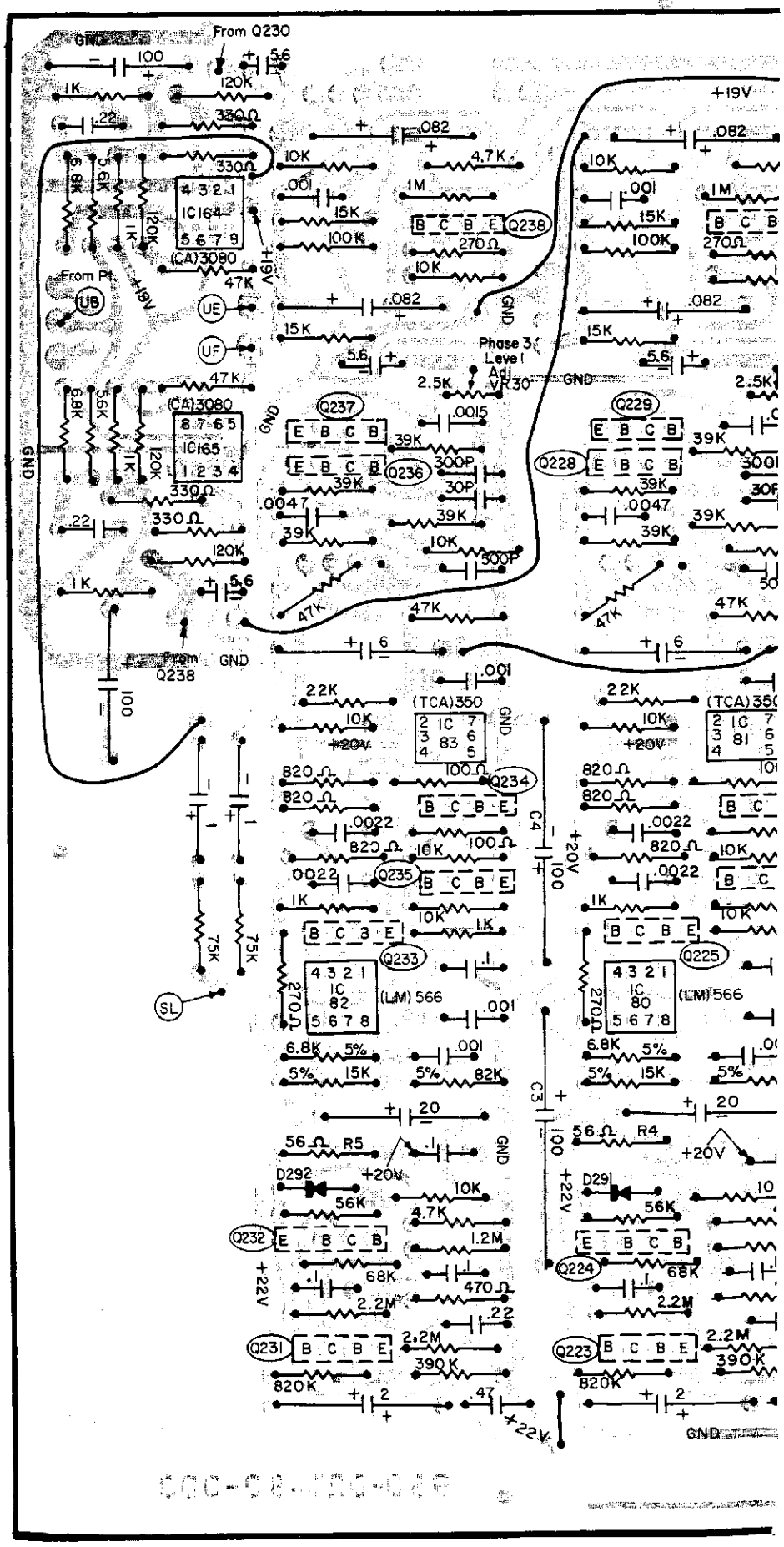


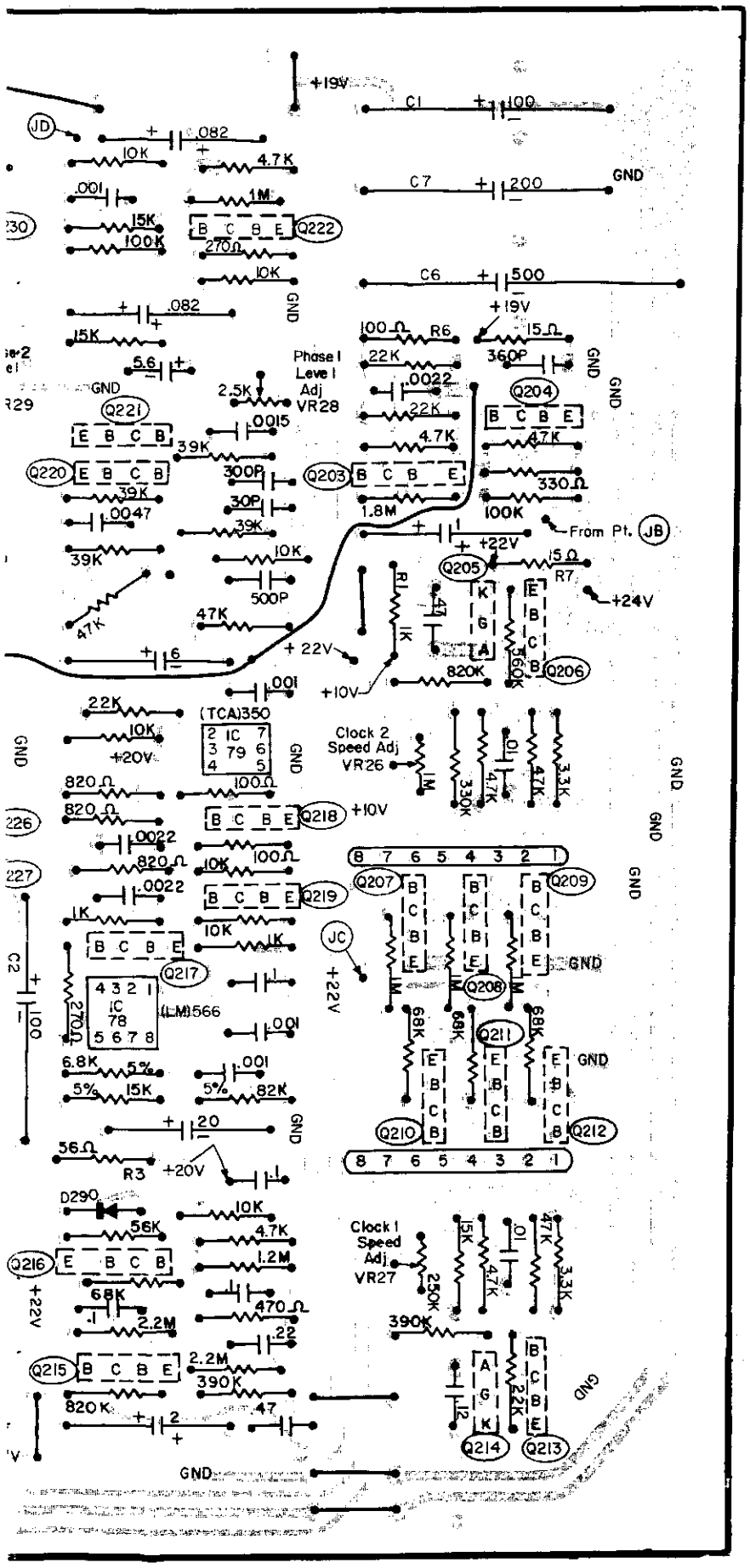
LOWER FLUTE SYMP.



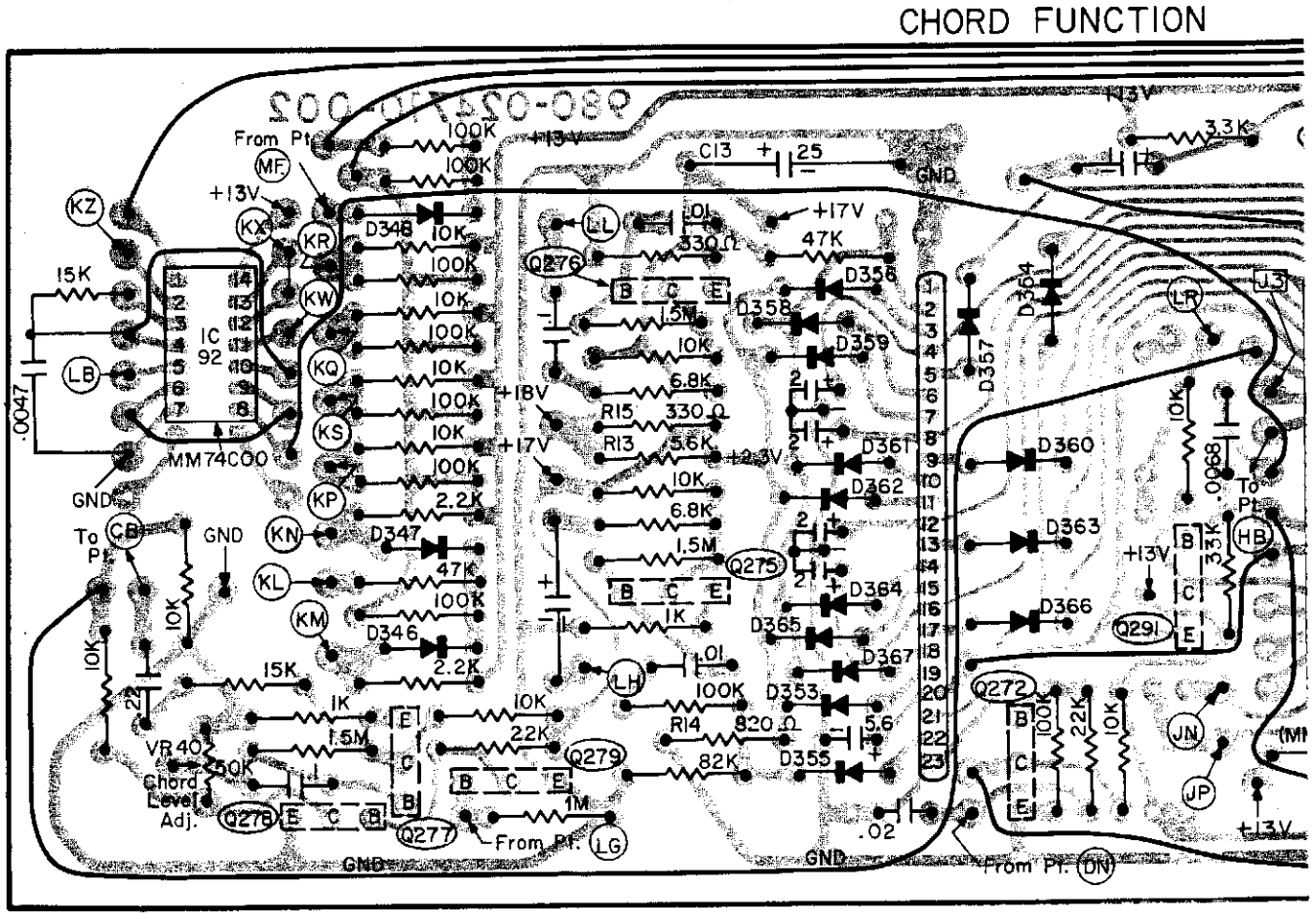
STRING FILTER BOARD

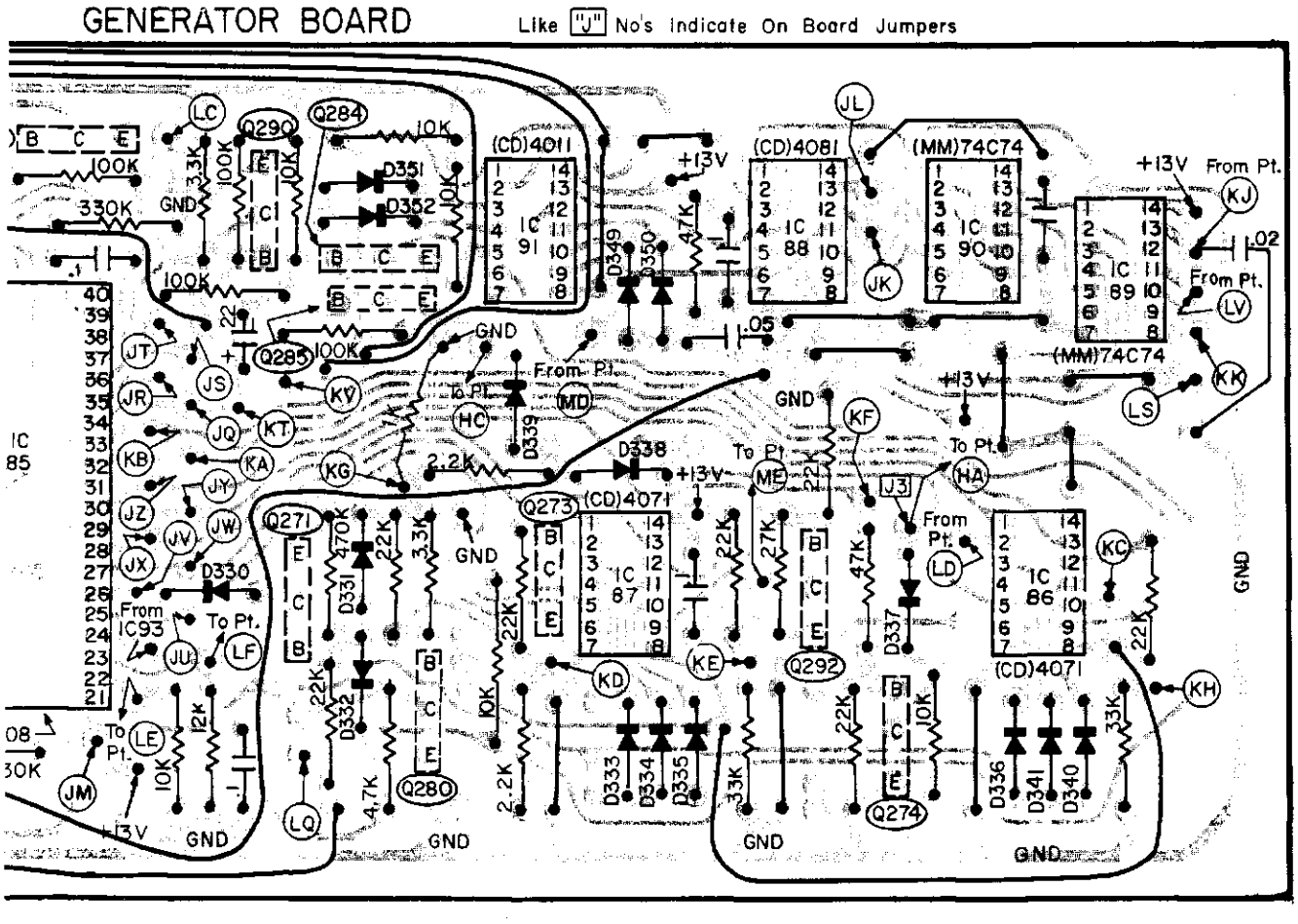


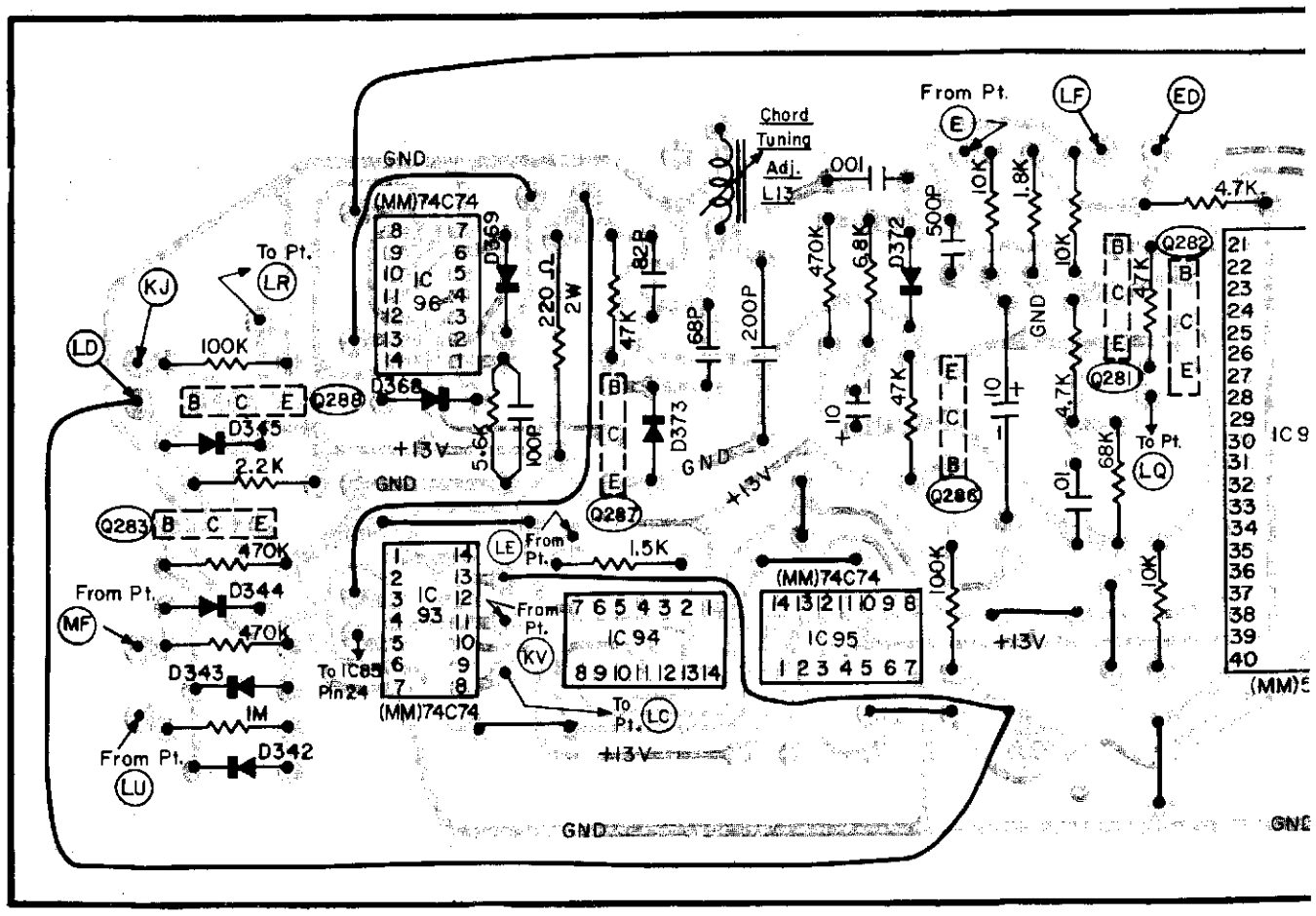

From Q230
GND
100
5.6
1K
120K
.22
330Ω
.082
10K
4.7K
.001
1M
15K
100K
Q238
270Ω
10K
(CA)3080
IC164
47K
From Pt.
UB
UE
UF
+19V
Phase 3 Level Adj VR30
2.5K
Q237
Q236
Q229
Q228
39K
.0015
300P
30P
.0047
6.8K
5.6K
1K
IC165
(CA)3080
Q238
(TCA)350
IC 82
(LM) 566
IC 80
(LM) 566
+20V
+22V
820Ω
100Ω
Q234
Q235
Q233
Q225
Q232
Q231
Q224
Q223
.0022
75K
SL
6.8K 5%
15K
82K
20
56Ω R5
D292
D29
56K
4.7K
1.2M
68K
470Ω
2.2M
.22
390K
820K
.47
R4
GND


+19V
C1
100
JD
.082
10K
4.7K
.001
1M
C7
200
GND
15K
Q222
100K
270Ω
10K
C6
500
+19V
.082
15K
100Ω
R6
22K
15Ω
360P
Phase I Level Adj VR28
2.5K
.0022
22K
Q204
Q221
.0015
4.7K
47K
Q220
39K
300P
Q203
330Ω
39K
.0047
30P
1.8M
100K
From Pt. JB
39K
39K
10K
+22V
Q205
15Ω
R7
+24V
500P
47K
47K
+ 22V
820K
Q206
.001
+10V
22K
(TCA)350
Clock 2 Speed Adj VR26
10K
+20V
820Ω
100Ω
820Ω
Q218
+10V
.0022
820Ω
100Ω
10K
.0022
Q219
1K
10K
1K
Q217
JC
+22V
270Ω
(LM)566
.001
6.8K 5%
5% 15K
.001
5% 82K
20
56Ω
R3
+20V
D290
10K
56K
4.7K
1.2M
Q216
68K
+22V
.1
2.2M
470Ω
.22
Q215
2.2M
390K
820K
2
.47
GND
Q207
Q209
Q208
Q211
Q210
Q212
Clock 1 Speed Adj VR27
250K
15K
.01
47K
3.3K
390K
22K
Q214
Q213

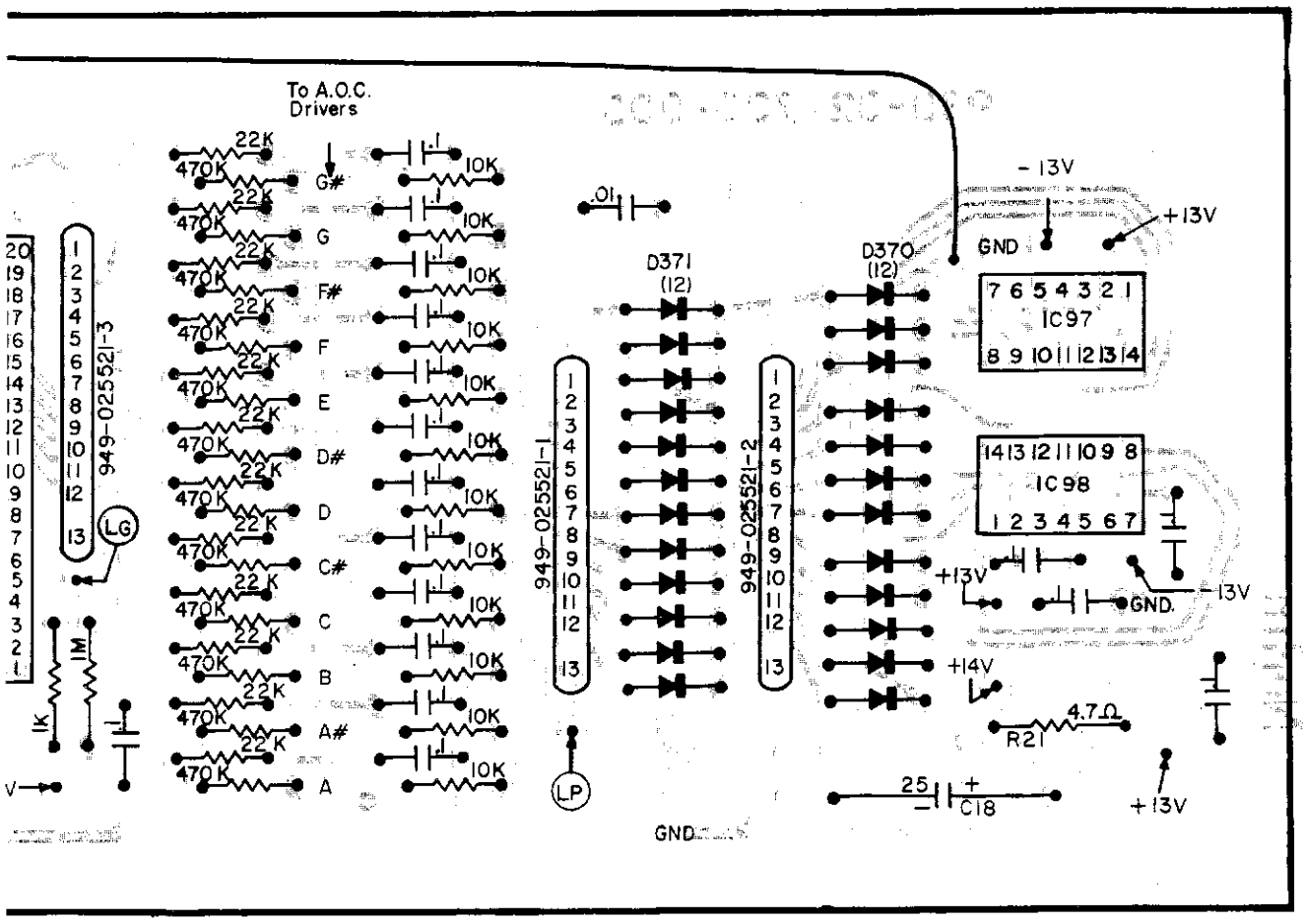
CHORD FUNCTION



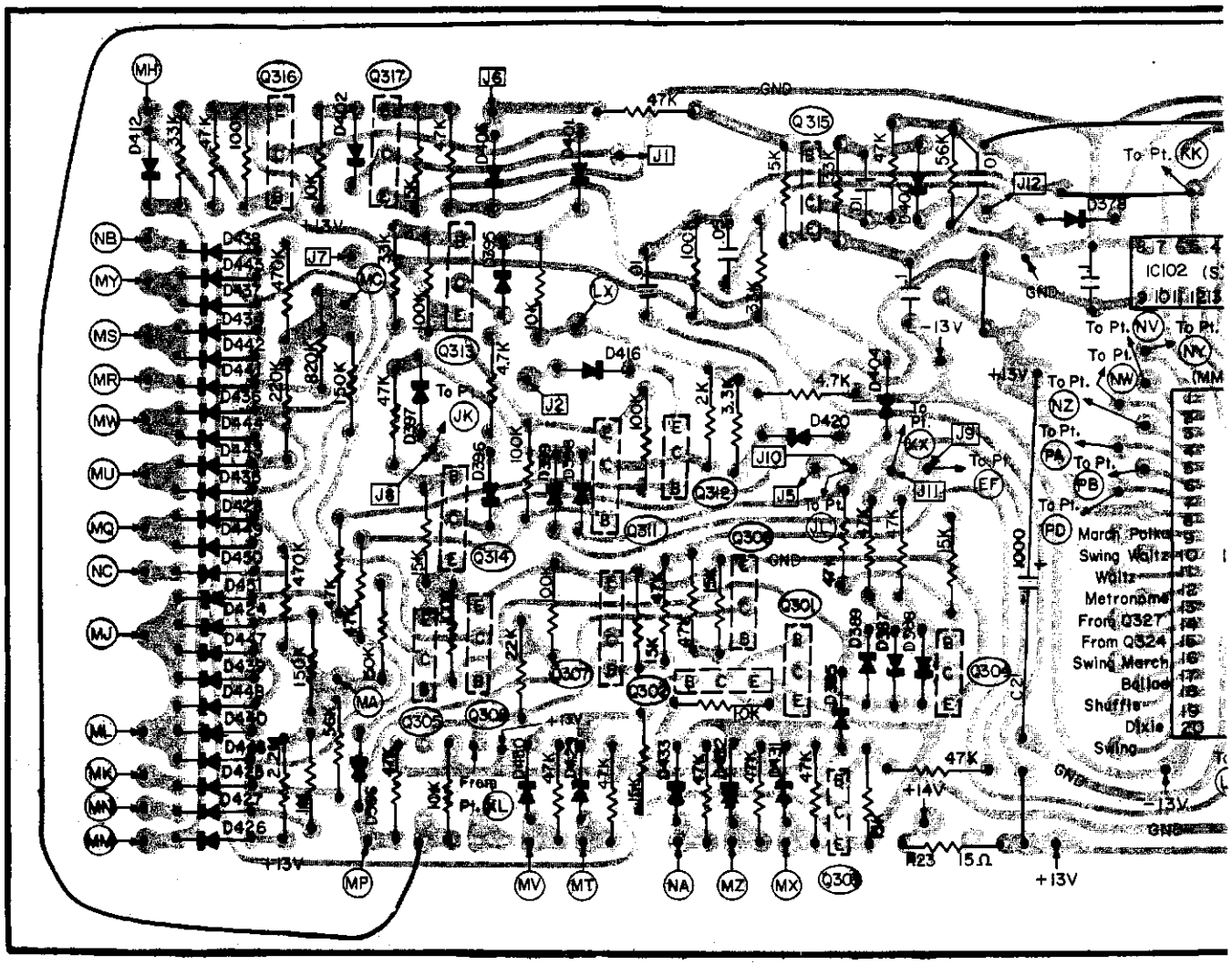

GENERATOR BOARD
Like "J" No's Indicate On Board Jumpers
(CD)4011
(CD)4081
(MM)74C74
(CD)4071
+13V
GND
From Pt.
To Pt.
From IC93
D330
D331
D332
D333
D334
D335
D336
D337
D338
D339
D340
D341
D349
D350
D351
D352
Q270
Q271
Q273
Q274
Q280
Q284
Q285
Q292
330K
100K
10K
3.3K
47K
22K
470K
27K
12K
4.7K
2.2K
.05
.02
.1


GND
(MM)74C74
IC 96
D369
D368
220 Ω 2W
82P
47K
68P
200P
Chord Tuning Adj. L13
001
From Pt. E
LF
ED
470K
6.8K
D372
500P
10K
1.8K
4.7K
Q282
Q281
Q286
Q287
Q288
D373
GND
+13V
10
47K
4.7K
68K
01
To Pt. FD
IC 9
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
(MM)7
To Pt. LR
KJ
LD
100K
D365
2.2K
5.6K
100P
Q283
470K
D344
From Pt. MF
D343
1M
From Pt. LU
D342
IC 93
To IC85 Pin24
LE
From Pt.
1.5K
From Pt. KV
IC 94
7 6 5 4 3 2 1
8 9 10 11 12 13 14
To Pt. LC
(MM)74C74
IC 95
14 13 12 11 10 9 8
1 2 3 4 5 6 7
100K
10K
+13V
GND

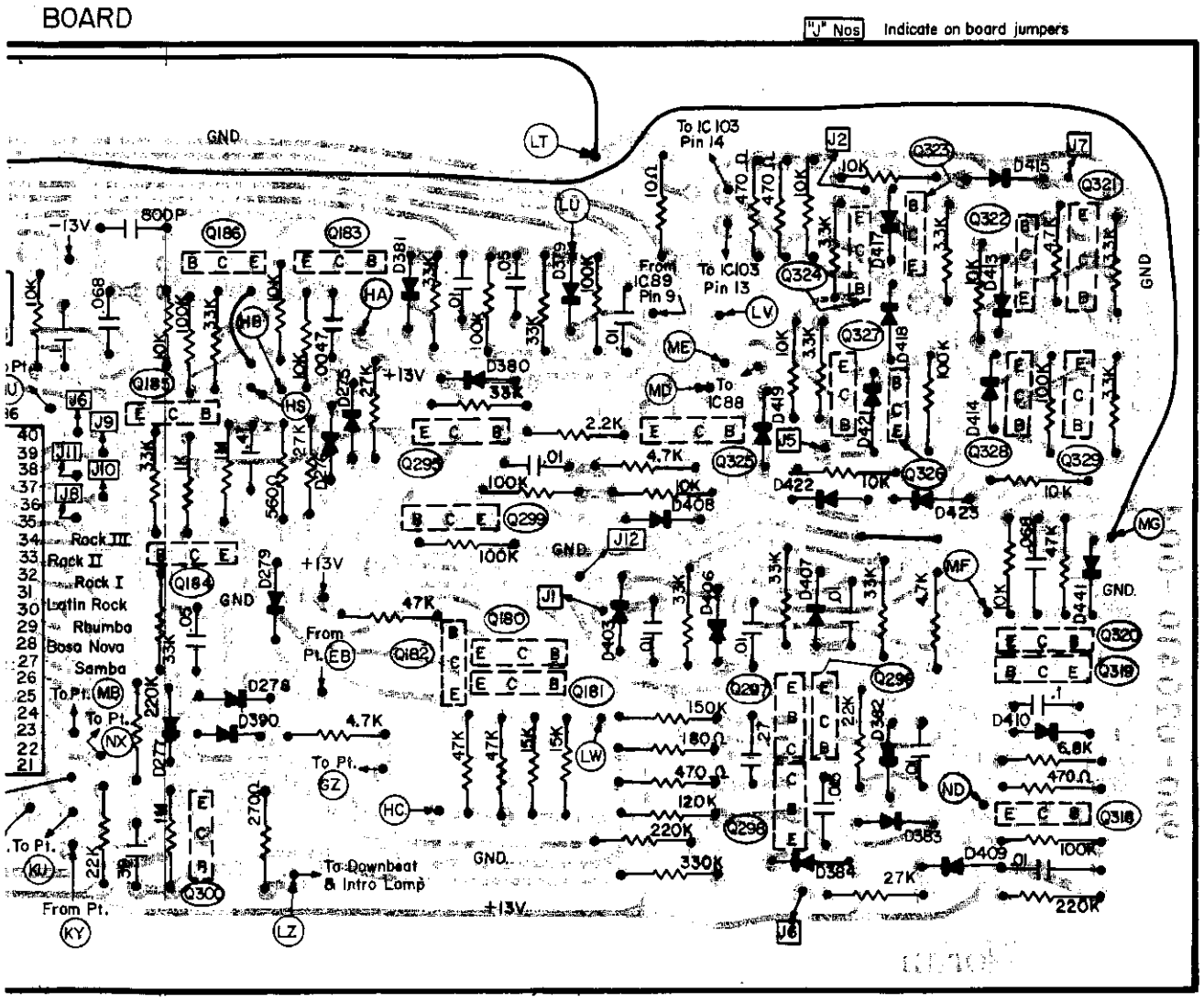
& OSC. BOARD

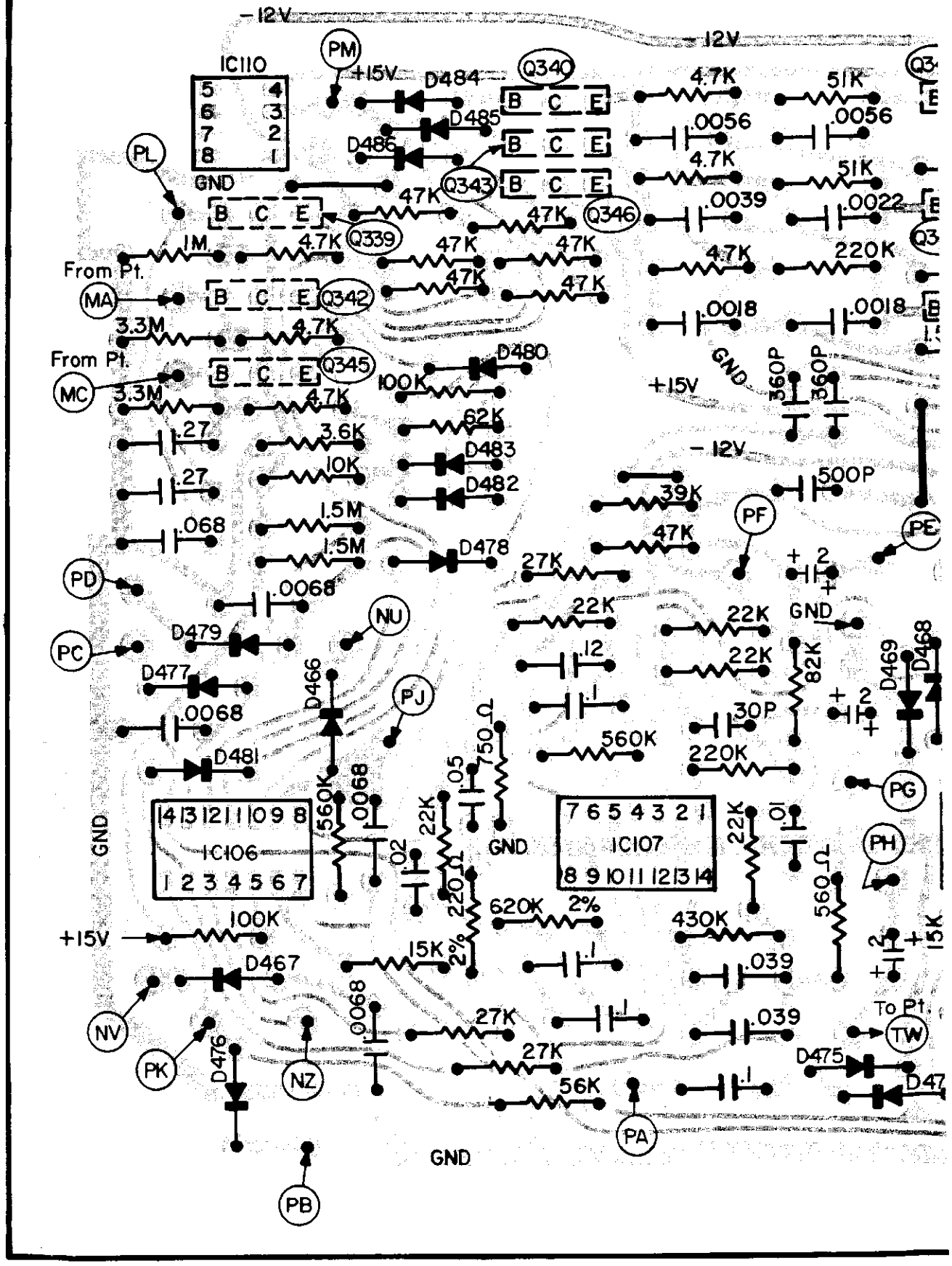

To A.O.C. Drivers
22K
470K
10K
G#
G
F#
F
E
D#
D
C#
C
B
A#
A
.01
D371 (12)
D370 (12)
949-025521-1
949-025521-2
949-025521-3
LG
LP
1K
1M
V
- 13V
+13V
GND
IC97
7 6 5 4 3 2 1
8 9 10 11 12 13 14
IC98
14 13 12 11 10 9 8
1 2 3 4 5 6 7
+14V
4.7Ω
R21
25
C18

RHYTHM CLOCK

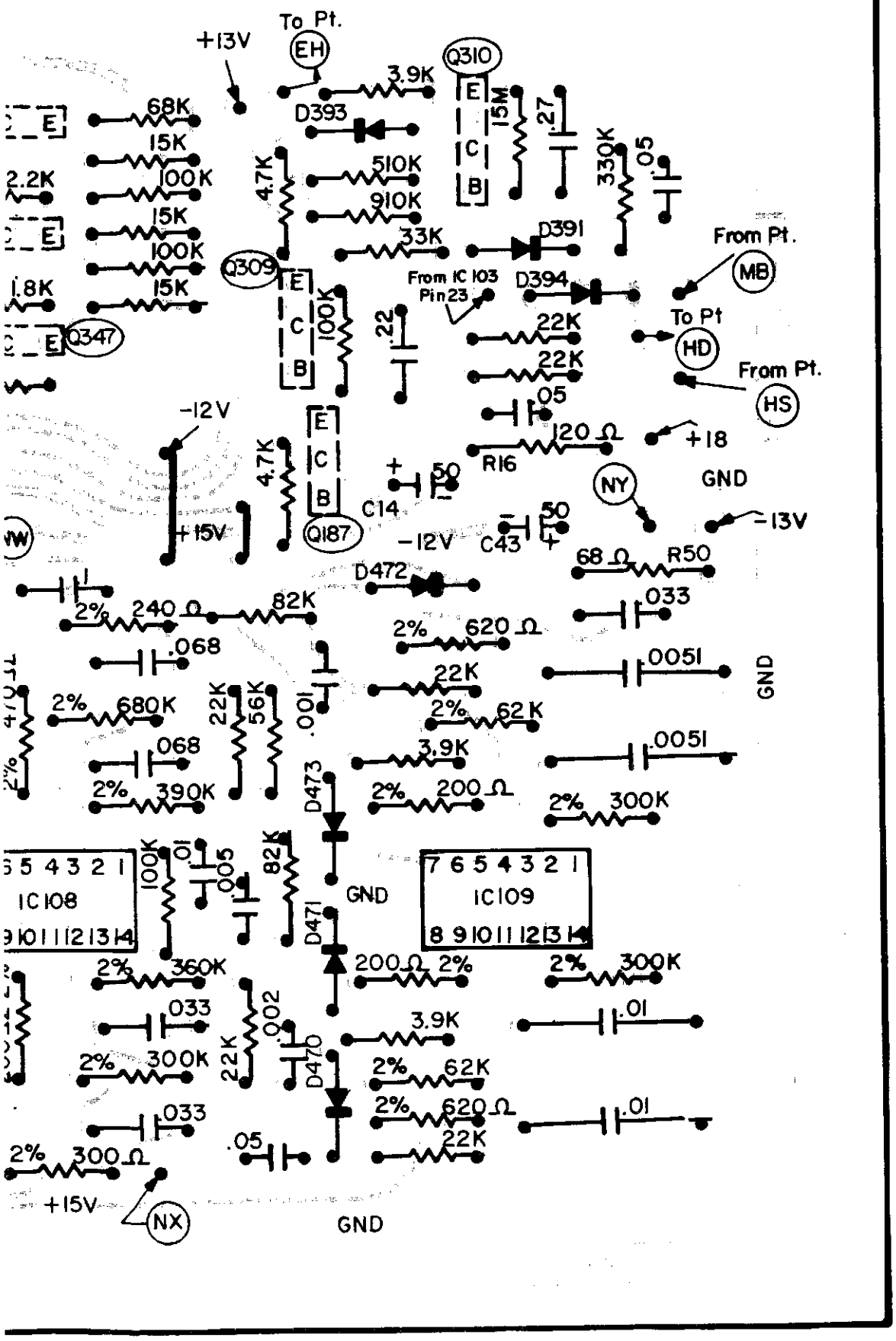


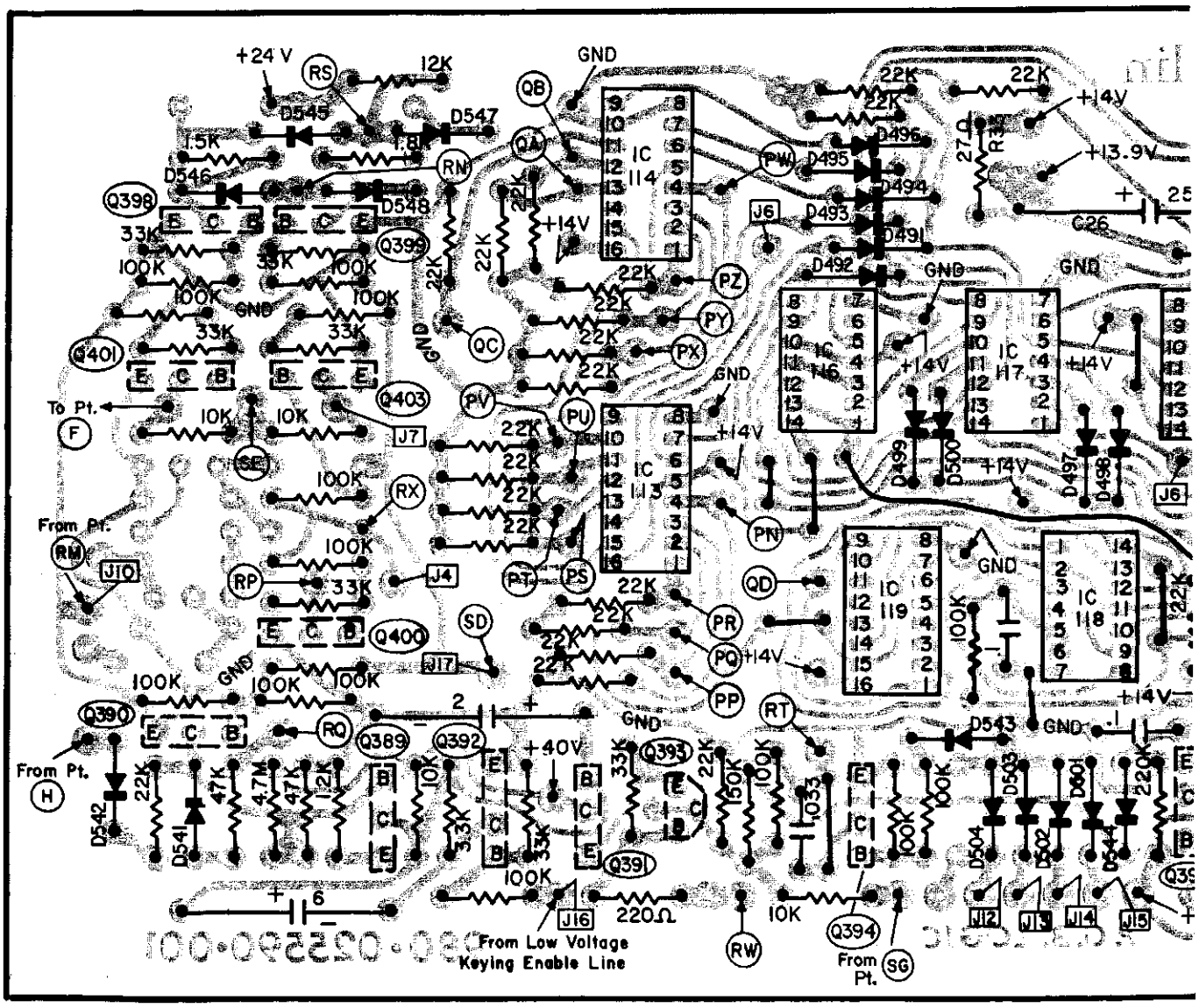
BOARD


"J" Nos Indicate on board jumpers
GND
LT
To IC 103 Pin 14
LU
From IC89 Pin 9
To IC103 Pin 13
LV
ME
MD
To IC88
-13V
800P
Q186
Q183
D381
D382
HA
HB
+13V
D380
33K
2.2K
4.7K
Q295
Q325
D422
10K
Q326
D425
D408
Q299
100K
GND.
J12
HS
Q185
J6
J9
J11
J10
J8
Rock III
Rock II
Rock I
Latin Rock
Rhumba
Bosa Nova
Samba
To Pt. MB
To Pt. NX
Q184
D279
From Pt. EB
Q182
47K
Q180
Q181
D278
D390
4.7K
D277
220K
To Pt. SZ
HC
150K
180Ω
470Ω
120K
220K
330K
Q298
D384
D383
27K
LW
ND
To Pt. KU
From Pt. KY
Q300
2700
To Downbeat & Intro Lamp
LZ
+13V
J1
J3
D403
D406
D407
Q297
Q296
D382
J2
J7
Q323
Q321
D415
Q322
Q324
D417
D413
Q327
D418
D419
D421
J5
Q325
Q328
Q329
D414
D441
MG
MF
Q320
Q319
D410
6.8K
470Ω
Q318
D409
100K
220K
J6

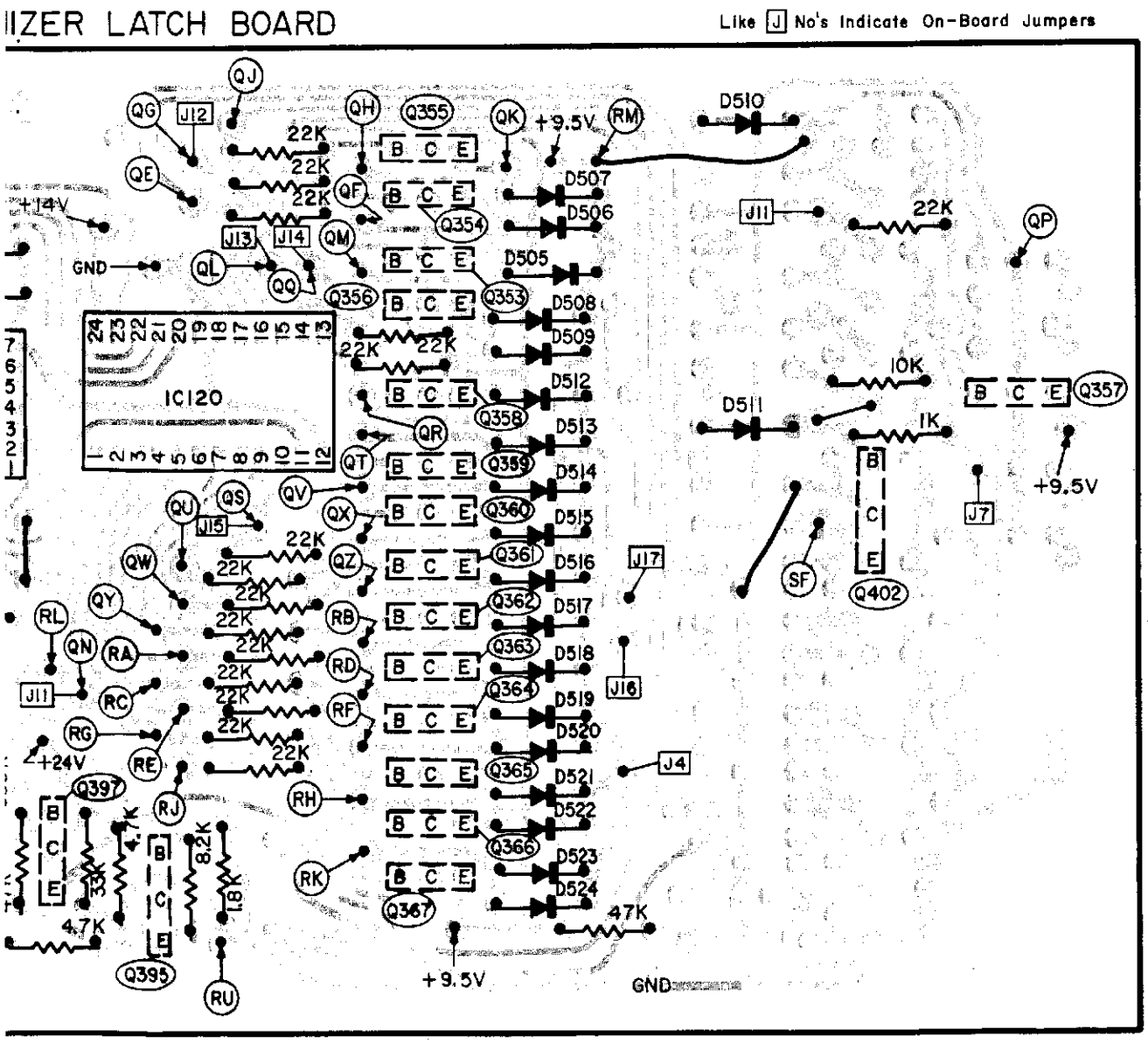

-12V
+12V
IC110
PM
+15V
D484
Q340
4.7K
51K
.0056
D485
D486
Q343
PL
GND
47K
Q346
B C E
Q339
1M
4.7K
From Pt.
MA
Q342
3.3M
MC
Q345
.27
3.6K
10K
1.5M
.068
PD
.0068
D480
100K
62K
D483
D482
D478
39K
PF
PE
500P
360P
27K
22K
.12
.1
560K
30P
82K
D469
D468
220K
PG
PC
D479
NU
D477
D466
PJ
D481
50Ω
.05
.02
.01
PH
620K
2%
430K
.039
15K
100K
+15V
D467
NV
PK
NZ
D476
27K
56K
To Pt.
TW
D475
D47
PA
PB
GND
IC106
IC107
1 2 3 4 5 6 7
14 13 12 11 10 9 8
7 6 5 4 3 2 1
8 9 10 11 12 13 14

ENTATION

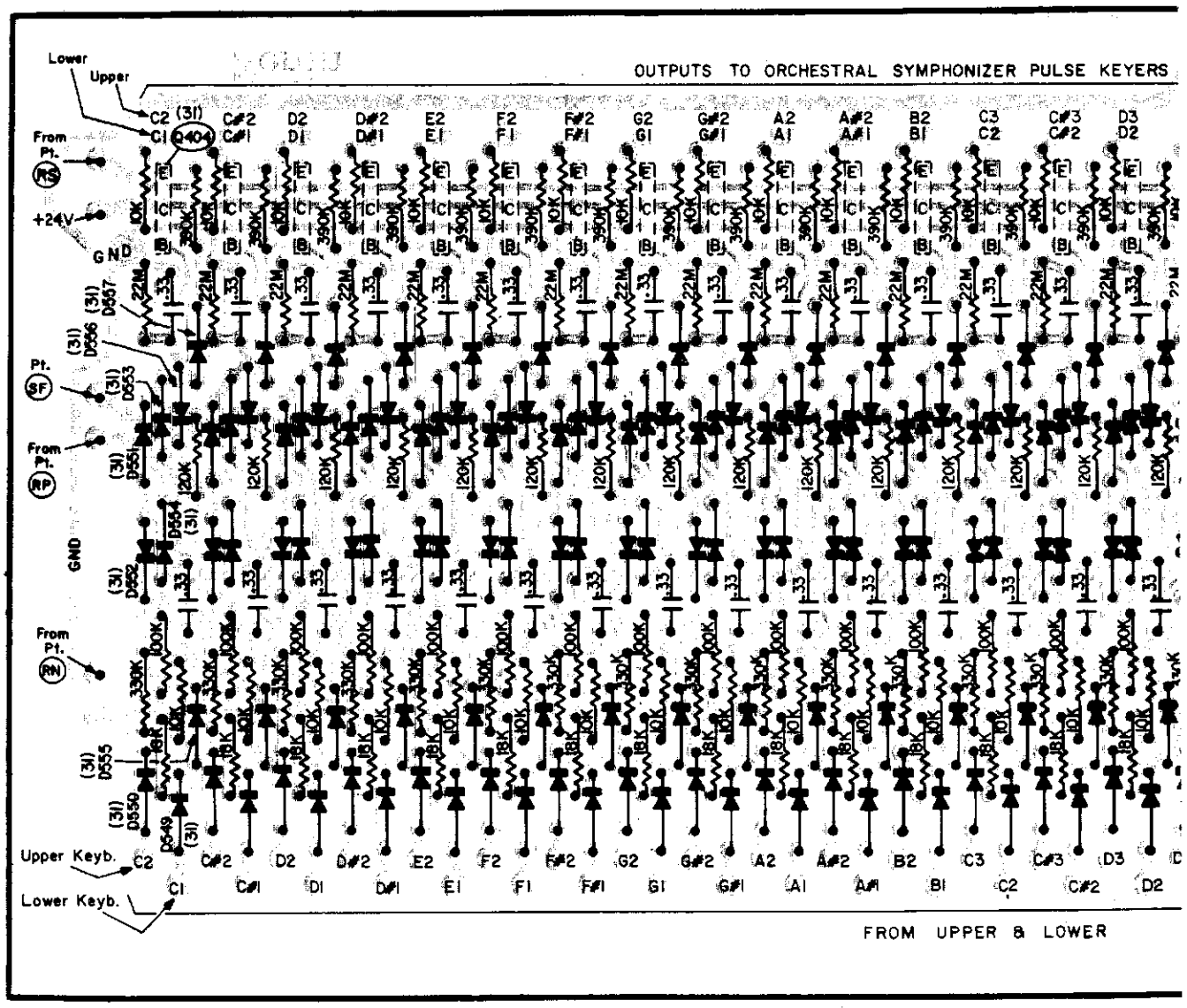

+13V
To Pt.
EH
3.9K
Q310
D393
68K
15K
100K
15K
100K
15K
2.2K
1.8K
Q347
4.7K
510K
910K
33K
15M
.27
330K
.05
.1
D391
From Pt.
MB
Q309
From IC 103 Pin 23
D394
22K
To Pt
HD
22K
From Pt.
HS
.05
120 Ω
+18
R16
-12V
4.7K
50
C14
Q187
NY
GND
+13V
+15V
-12V
C43
50
68 Ω
R50
D472
.033
2% 240 Ω
82K
2% 620 Ω
.068
22K
.0051
GND
2% 680K
22K
56K
.001
2% 62K
.068
3.9K
.0051
2% 390K
2% 200 Ω
2% 300K
D473
5 4 3 2 1
IC108
9 10 11 12 13 14
100K
.01
.005
82K
GND
7 6 5 4 3 2 1
IC109
8 9 10 11 12 13 14
D471
2% 360K
200 Ω 2%
2% 300K
.033
.002
3.9K
.01
2% 300K
22K
D470
2% 62K
.033
2% 620 Ω
.01
.05
22K
2% 300 Ω
+15V
NX
GND


+24 V
RS
12K
D545
D547
1.5K
1.8K
RN
D546
D548
Q398
Q399
33K
100K
GND
Q401
Q403
To Pt. F
10K
J7
SE
RX
From Pt. RM
J10
RP
J4
Q400
SD
J17
Q390
From Pt. H
Q389
RQ
Q392
2
+40V
Q393
Q391
6
J16
From Low Voltage Keying Enable Line
220Ω
RW
Q394
From Pt. SG
10K
QA
QB
QC
QD
IC 114
IC 113
IC 116
IC 117
IC 119
IC 118
PW
PZ
PY
PX
PV
PU
PT
PS
PR
PQ
PP
PN
+14V
22K
D495
D496
D494
D493
D491
D492
R34
27Ω
+13.9V
C26
GND
D499
D500
D497
D498
J6
D543
RT
100K
.1
D503
D504
D502
D501
J12
J13
J14
J15
220

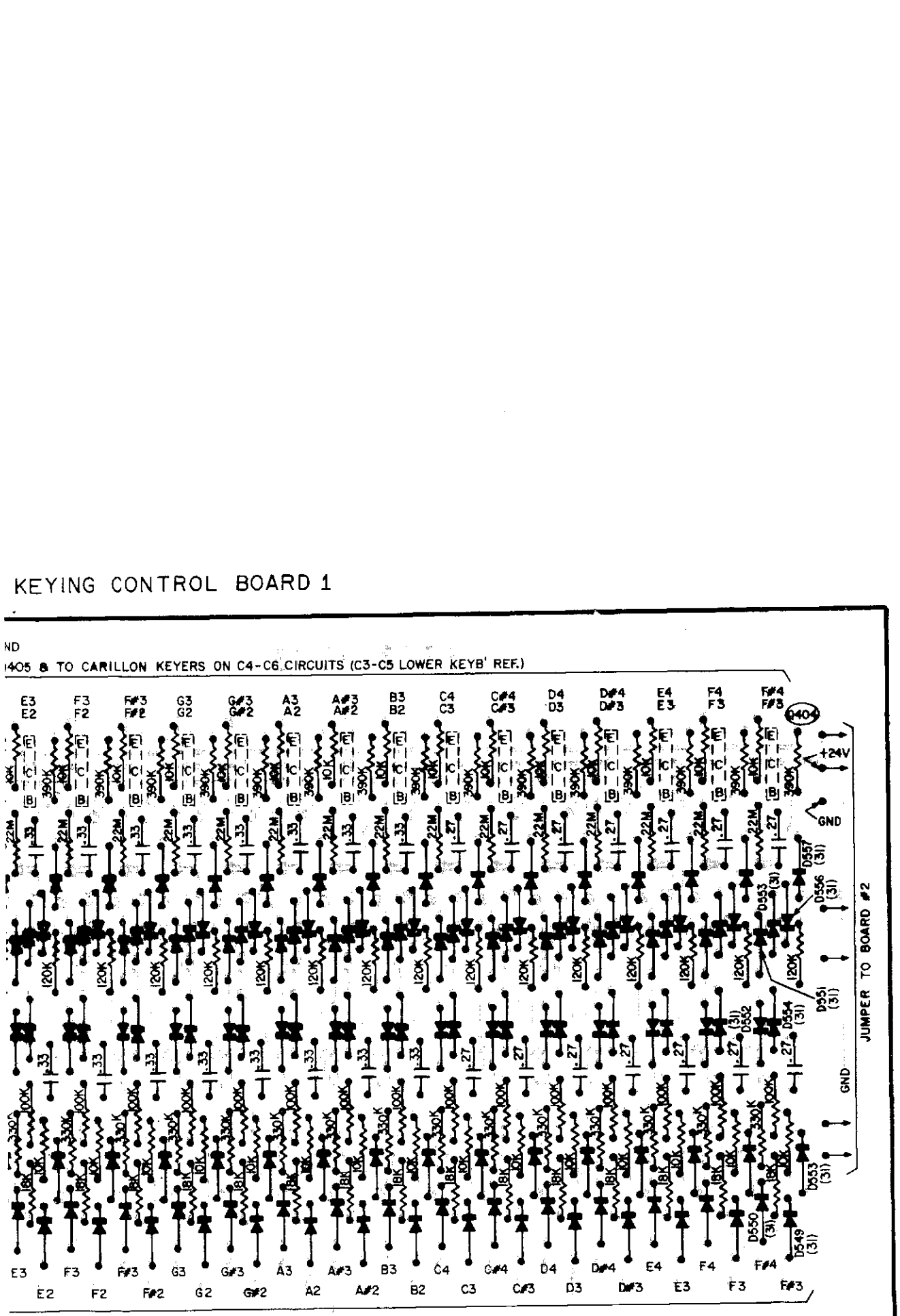
IIZER LATCH BOARD



ORCHESTRAL SYMPHONIZER

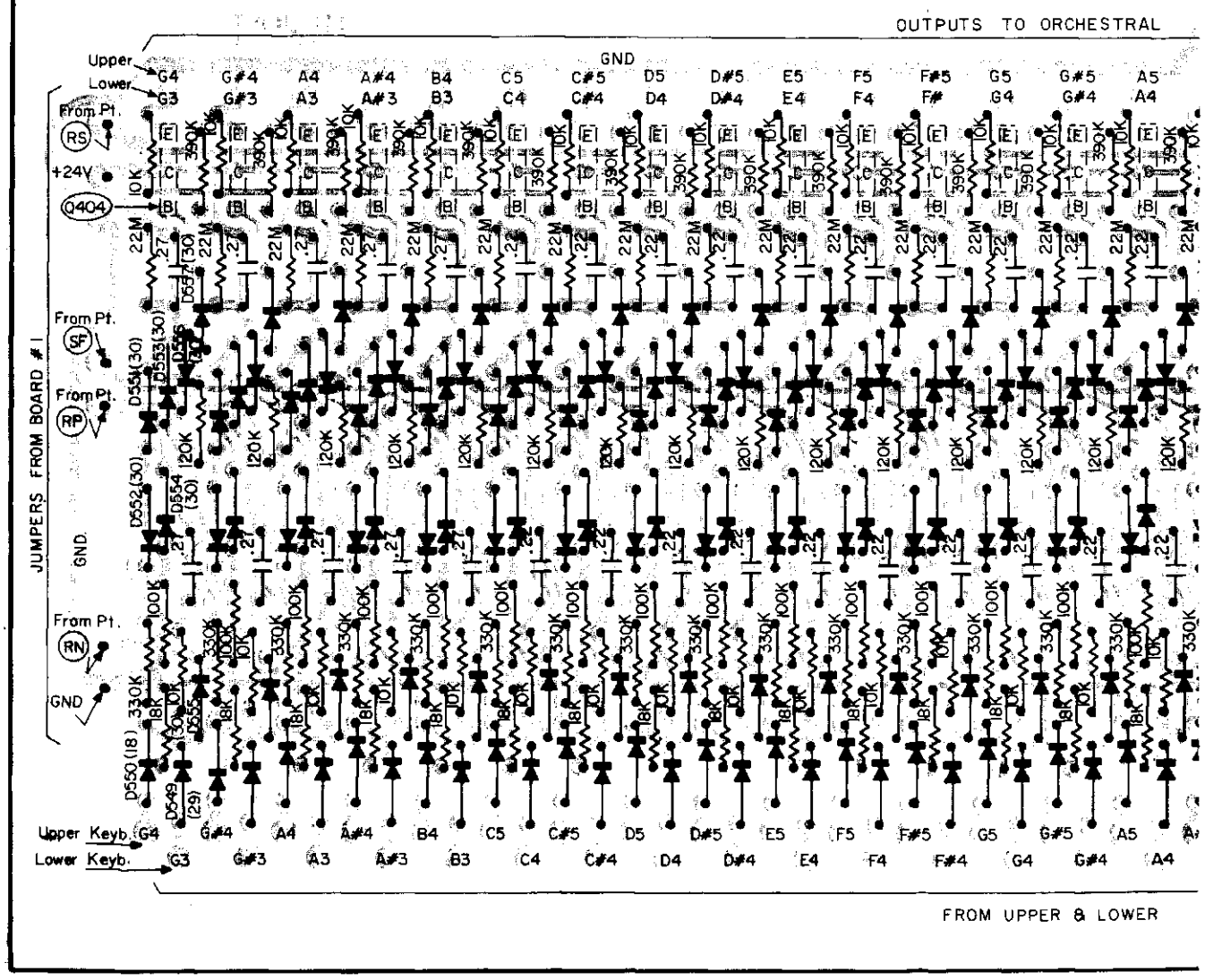


KEYING CONTROL BOARD 1

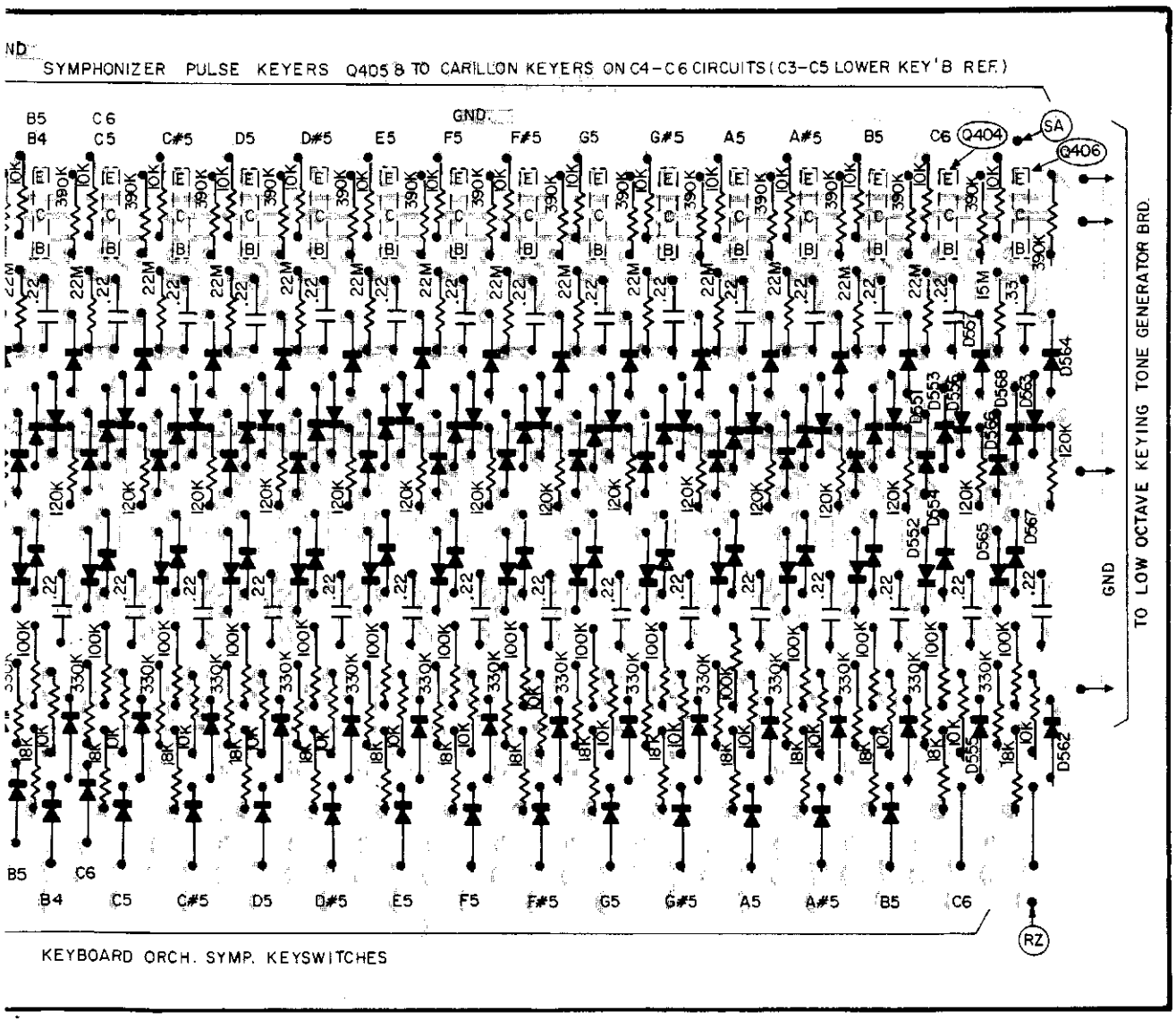


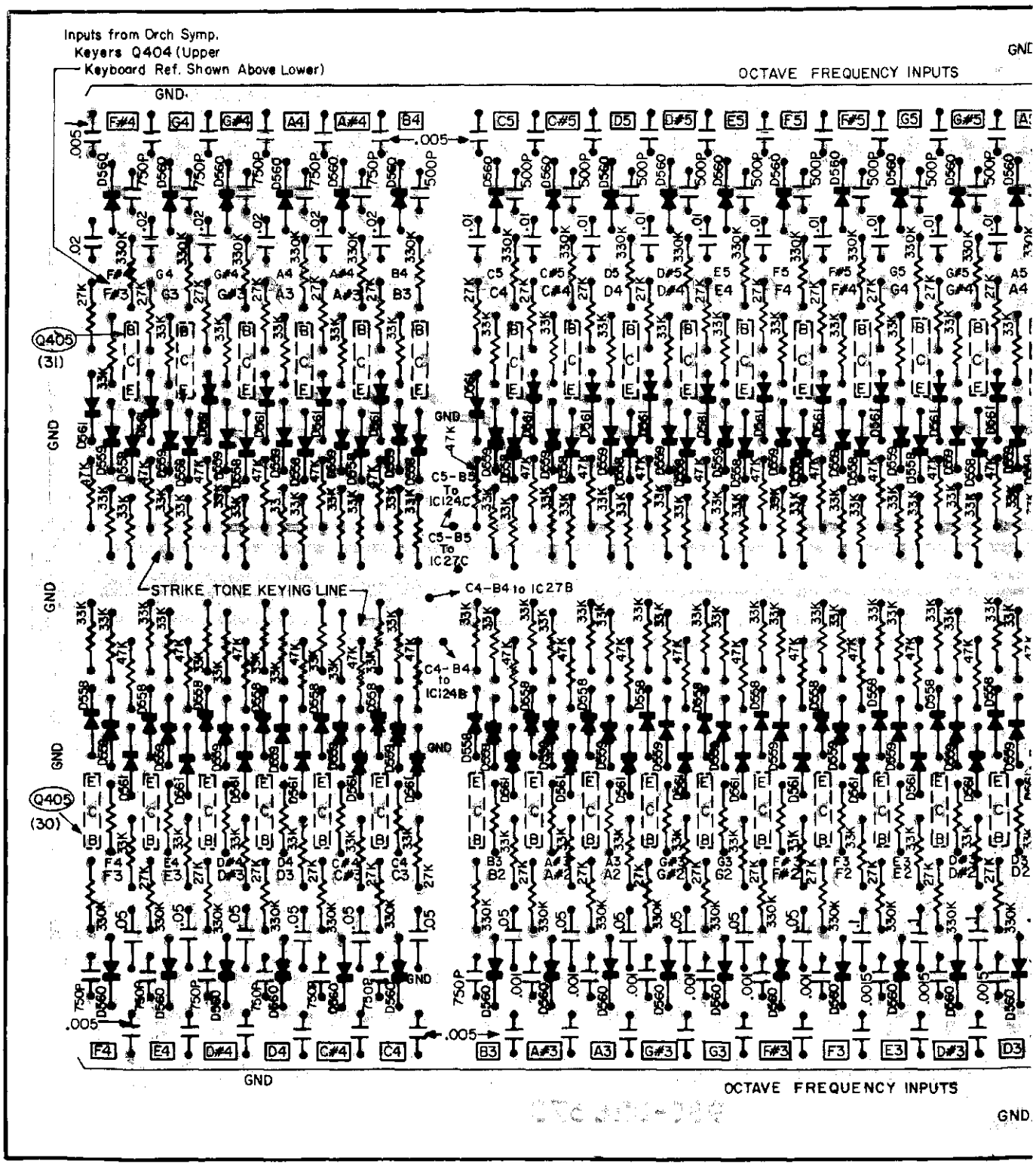
KEYBOARD ORCH. SYMP. KEYSWITCHES

ORCHESTRAL SYMPHONIZER

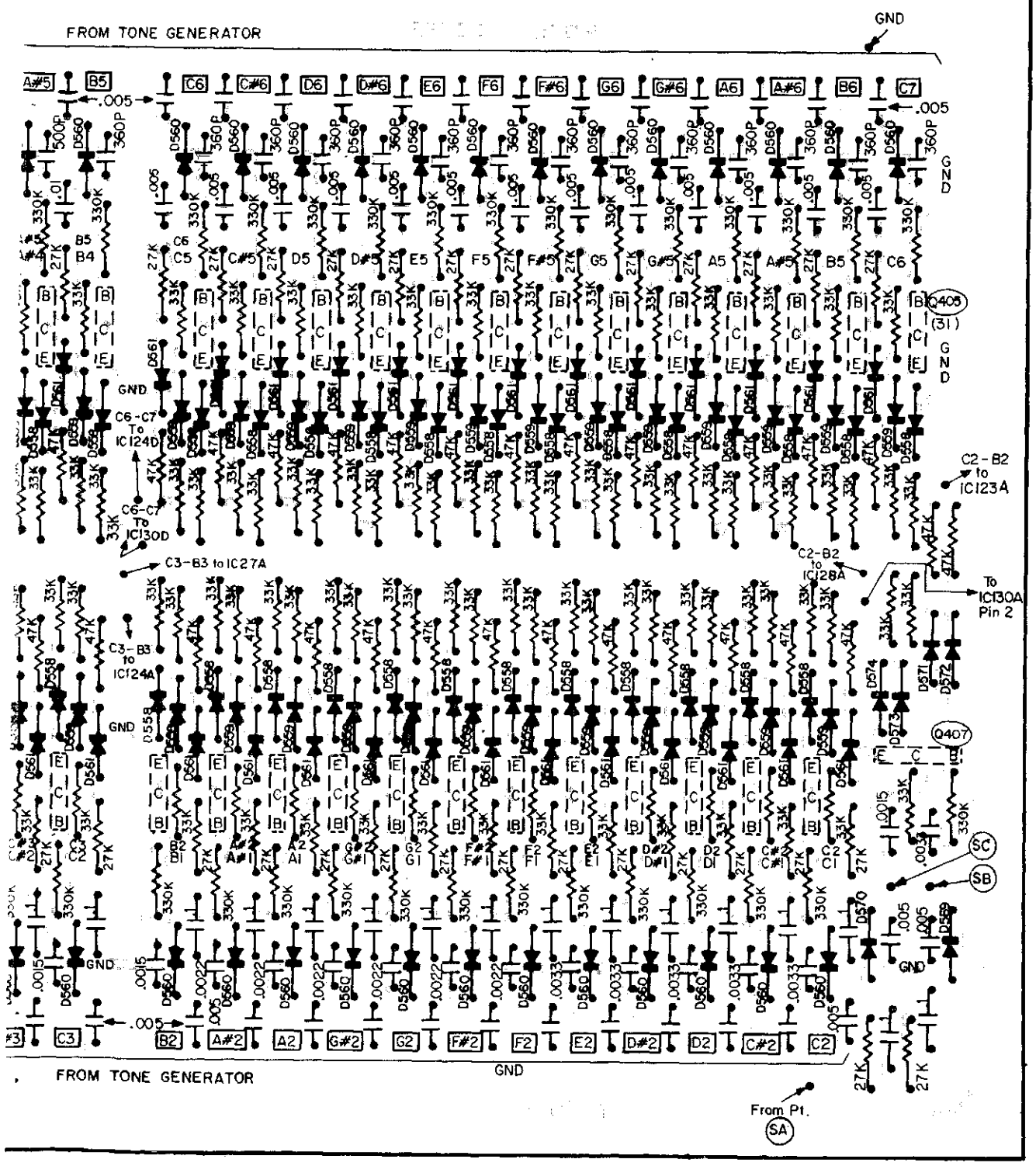

OUTPUTS TO ORCHESTRAL
GND
Upper
Lower
G4 G#4 A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5
G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F# G4 G#4 A4
From Pt. RS
+24V
Q404
From Pt. SF
From Pt. RP
JUMPERS FROM BOARD #1
GND.
From Pt. RN
GND
Upper Keyb. G4 G#4 A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5
Lower Keyb. G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4 A4
FROM UPPER & LOWER

KEYING CONTROL BOARD 2

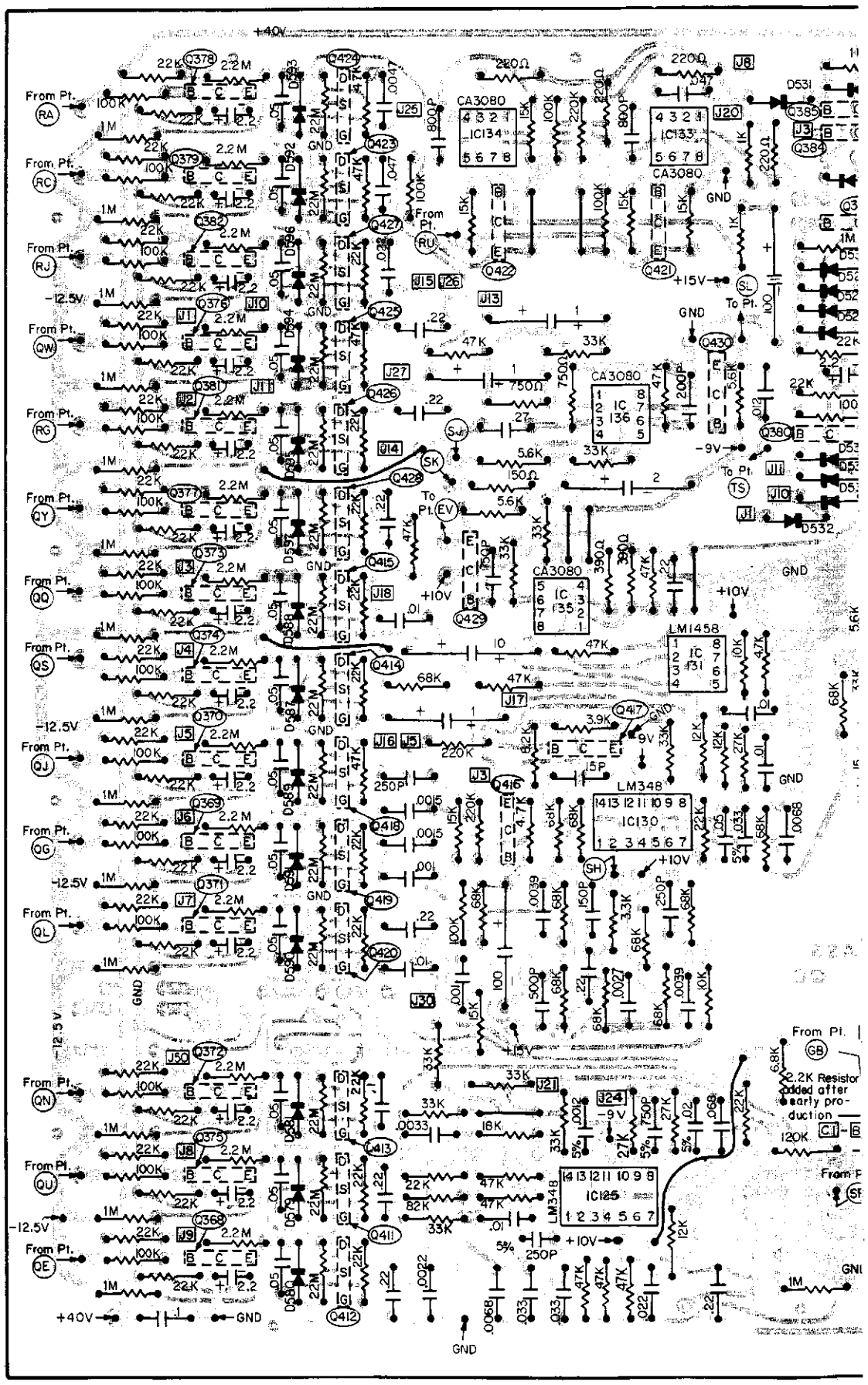

ND
SYMPHONIZER PULSE KEYERS Q405 & TO CARILLON KEYERS ON C4-C6 CIRCUITS (C3-C5 LOWER KEY'B REF.)
GND
B5 C6
B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6
Q404
Q406
SA
TO LOW OCTAVE KEYING TONE GENERATOR BRD.
GND
RZ
KEYBOARD ORCH. SYMP. KEYSWITCHES


Inputs from Orch Symp.
Keyers Q404 (Upper
Keyboard Ref. Shown Above Lower)
GND
OCTAVE FREQUENCY INPUTS
GND
Q405
(31)
Q405
(30)
STRIKE TONE KEYING LINE
C4-B4 to IC27B
C5-B5 To IC27C
C4- B4 to IC124B
C5-B5 To IC124C
GND
OCTAVE FREQUENCY INPUTS
GND

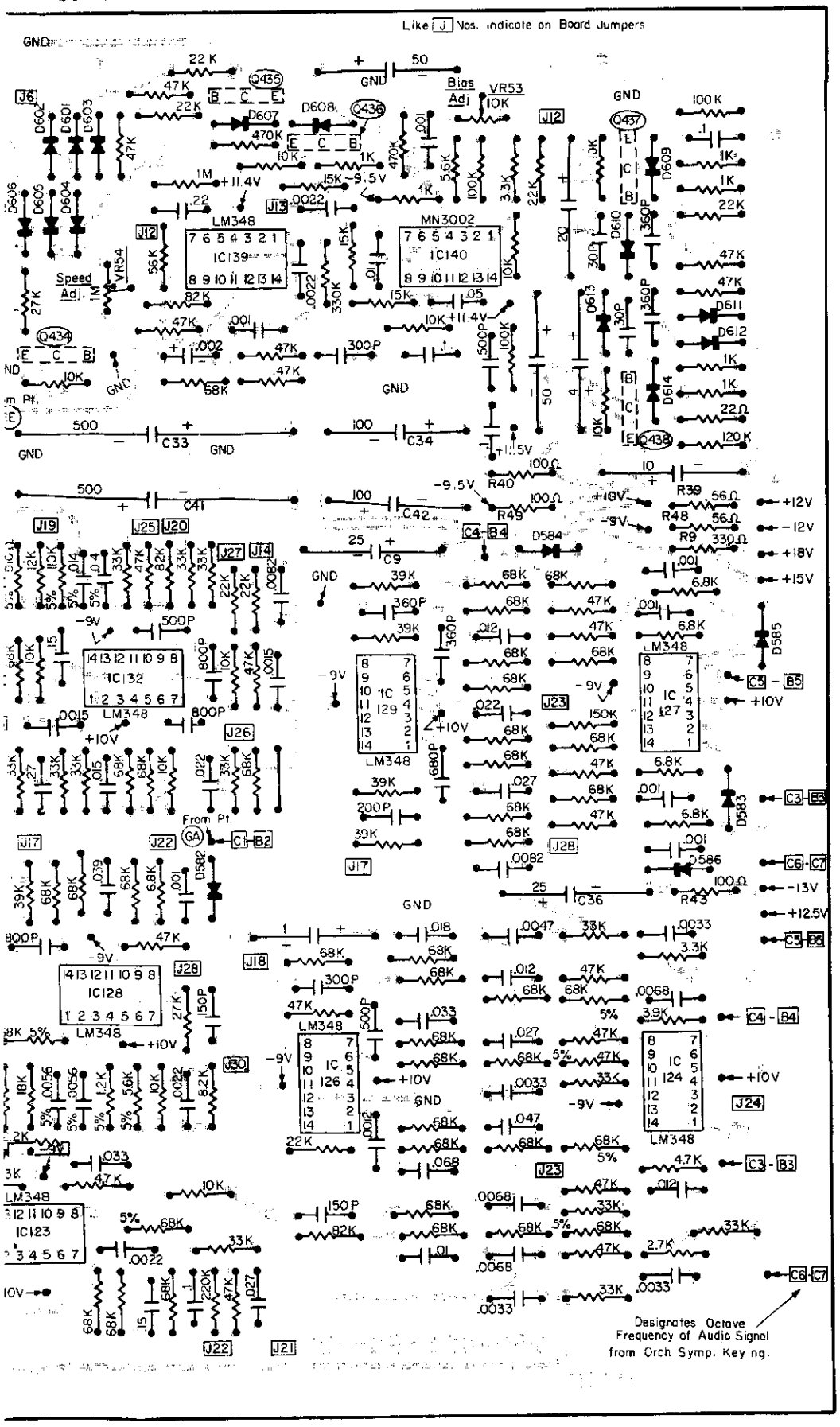
KEYER BOARD

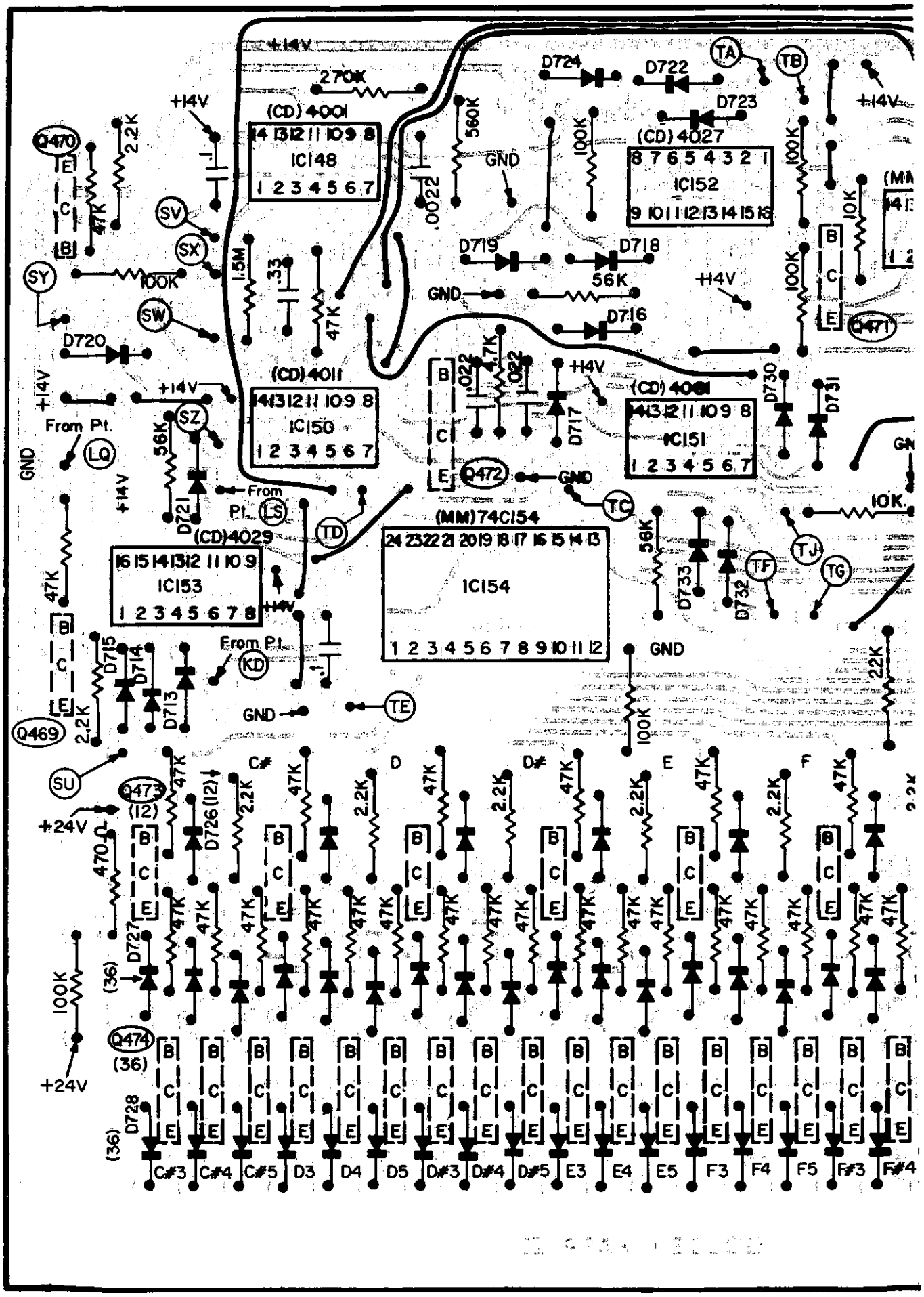

FROM TONE GENERATOR
GND
A#5 B5 C6 C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7
.005
.005
B5 B4 C6 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6
Q405
C6-C7 To IC124D
C6-C7 To IC130D
C3-B3 to IC27A
C2-B2 to IC123A
C2-B2 to IC128A
To IC130A Pin 2
C3-B3 to IC124A
Q407
SC
SB
C3 B2 A#2 A2 G#2 G2 F#2 F2 E2 D#2 D2 C#2 C2
FROM TONE GENERATOR
GND
From Pt. SA

ORCHESTRAL SYMPHONIZER

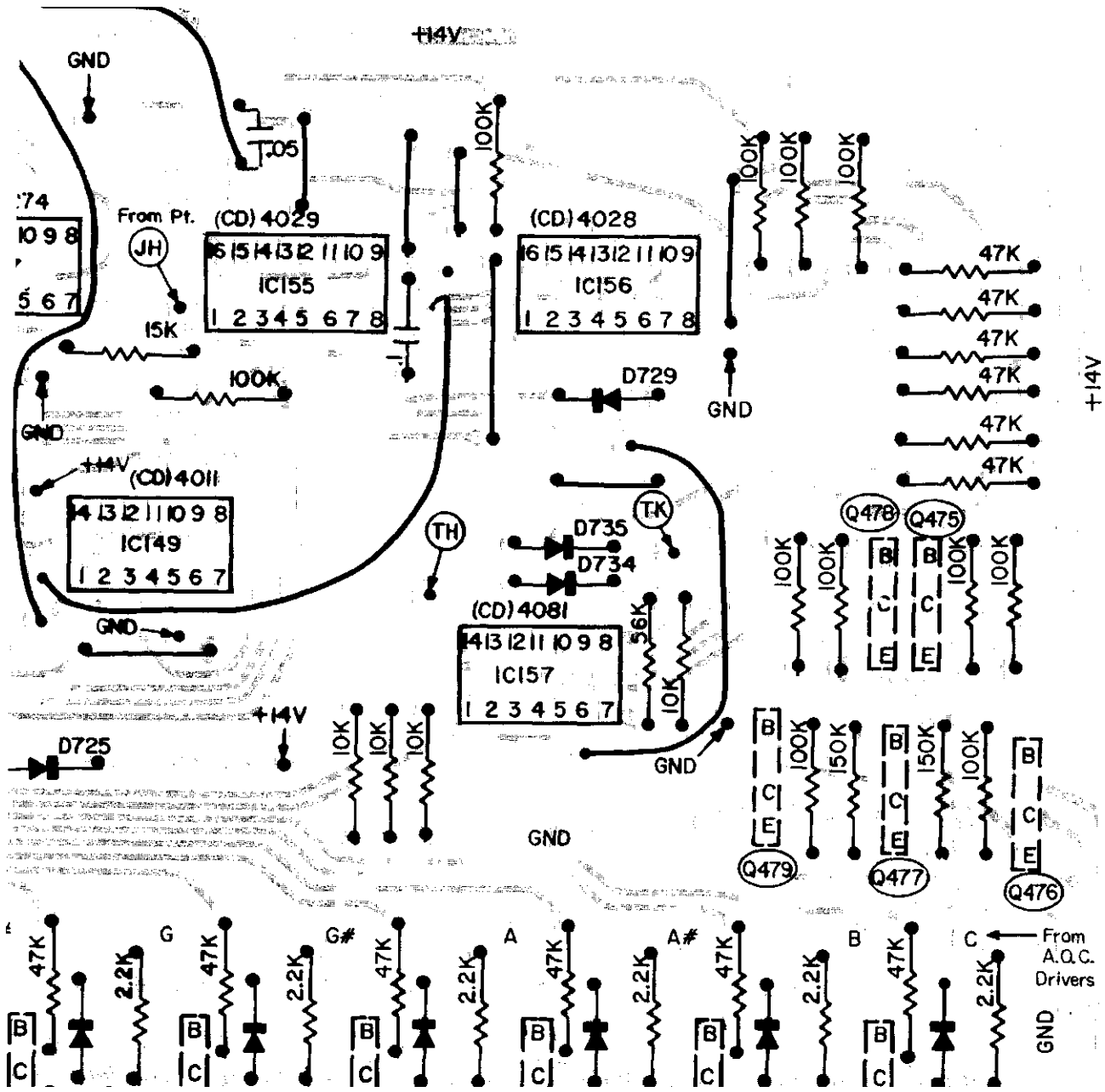


QUALITY CONTROL BOARD

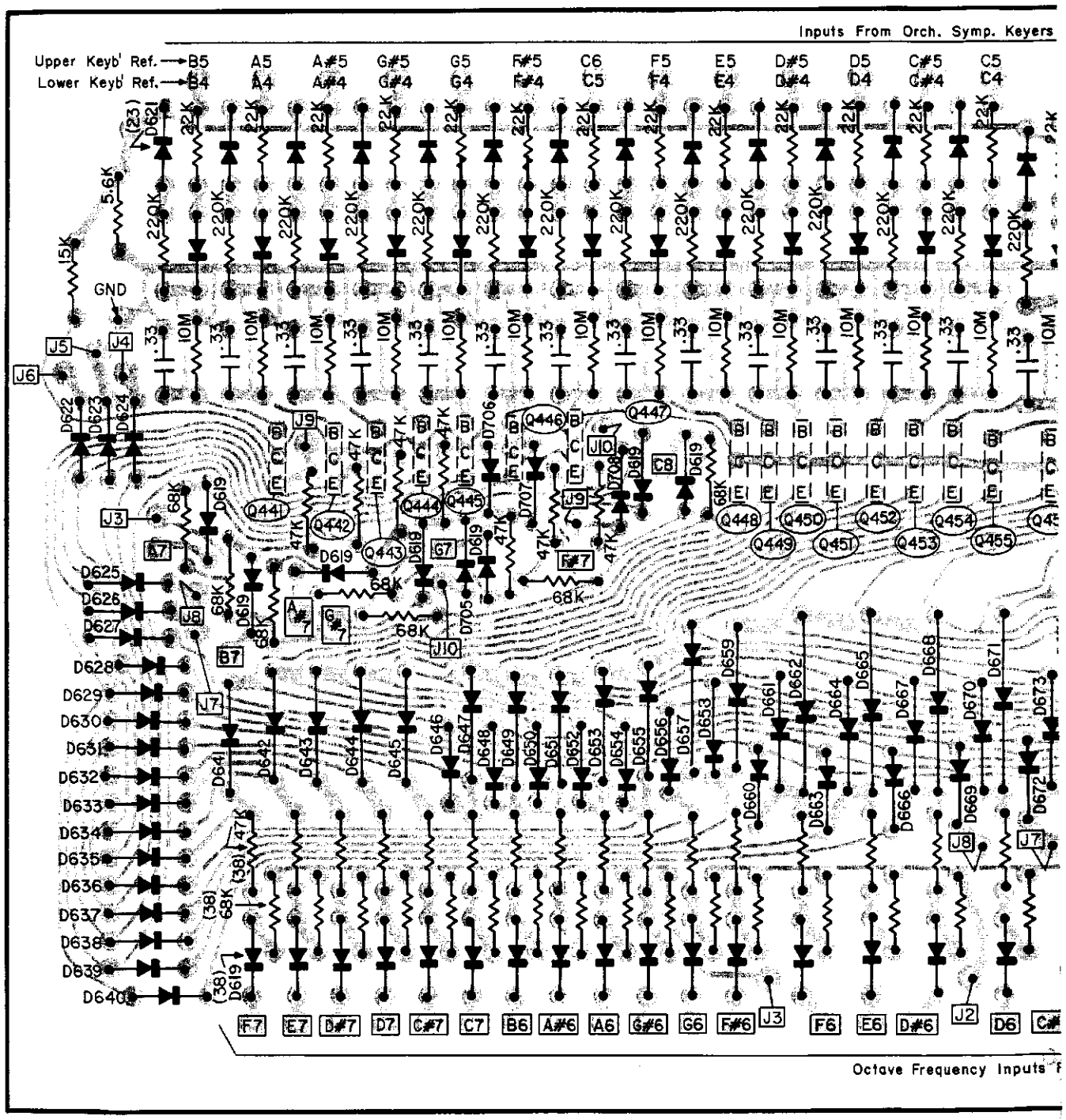



+14V
270K
(CD) 4001
IC148
Q470
2.2K
47K
SV
SX
SY
100K
SW
1.5M
.33
47K
D720
+14V
From Pt. LQ
GND
+14V
SZ
56K
D721
From Pt. LS
TD
(CD)4029
IC153
47K
D715
D714
D713
From Pt. KD
GND
TE
Q469
2.2K
SU
Q473
(12)
+24V
470
D726(12)
C#
D
D#
E
F
100K
(36)
Q474
(36)
+24V
D728
C#3 C#4 C#5 D3 D4 D5 D#3 D#4 D#5 E3 E4 E5 F3 F4 F5 F#3 F#4
560K
.0022
GND
100K
D724
D722
D723
TA
TB
+14V
(CD) 4027
IC152
100K
10K
B
C
E
Q471
D719
D718
56K
GND
+14V
D716
.022
4.7K
.022
+14V
D717
B
C
E
Q472
GND
TC
(CD) 4081
IC151
D730
D731
10K
(MM)74C154
IC154
56K
D733
D732
TF
TJ
TG
GND
22K
100K

BOARD

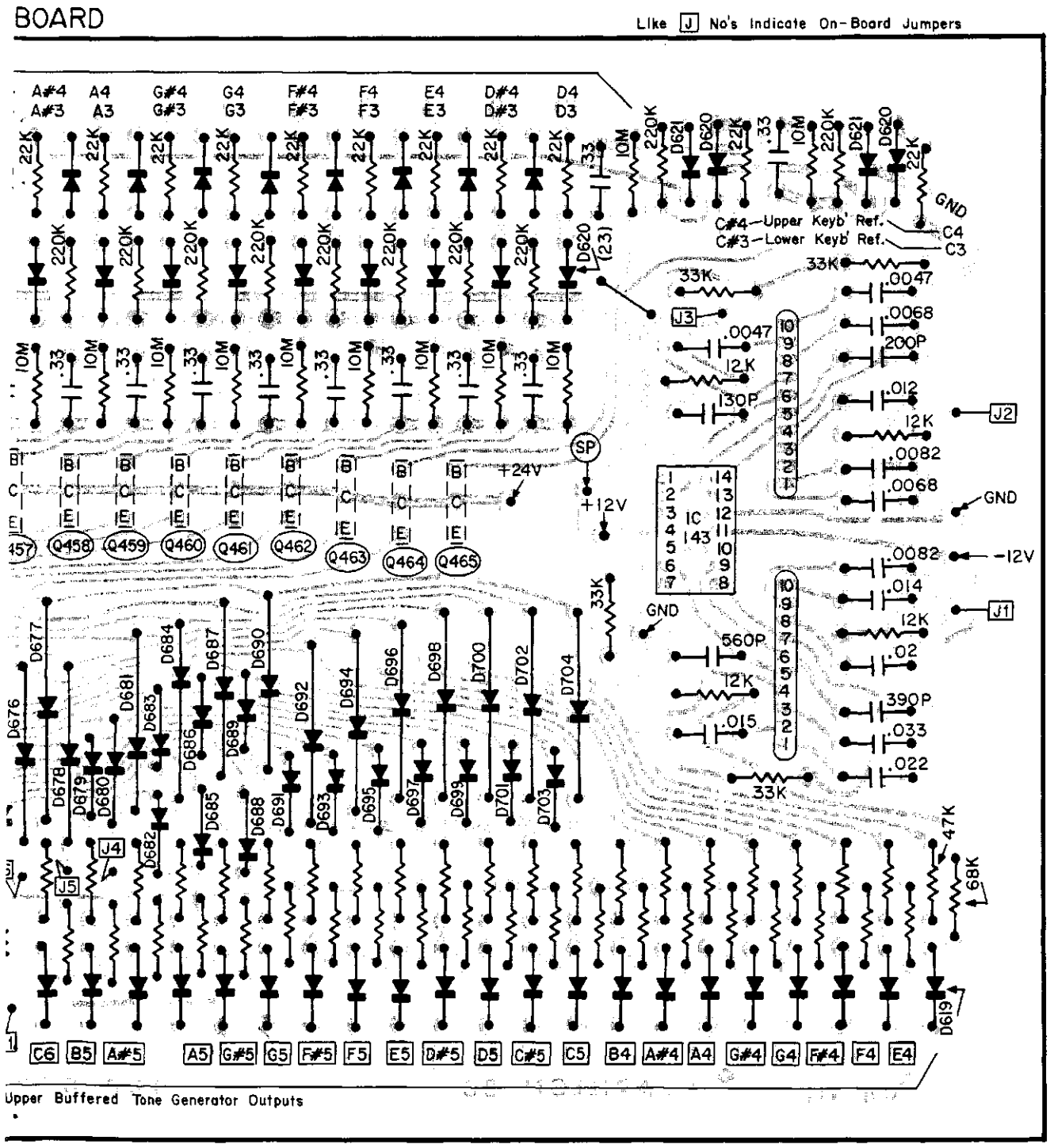

+14V
GND
.05
100K
From Pt.
JH
(CD)4029
6 15 14 13 12 11 10 9
IC155
1 2 3 4 5 6 7 8
(CD)4028
6 15 14 13 12 11 10 9
IC156
1 2 3 4 5 6 7 8
15K
100K
D729
GND
47K
+14V
(CD)4011
4 13 12 11 10 9 8
IC149
1 2 3 4 5 6 7
TH
TK
D735
D734
(CD)4081
14 13 12 11 10 9 8
IC157
1 2 3 4 5 6 7
56K
10K
Q478
Q475
B
C
E
D725
Q479
Q477
Q476
150K
G
G#
A
A#
B
C
2.2K
From A.Q.C. Drivers
To Upper Diode s Keying Circuits

CARILLON


Inputs From Orch. Symp. Keyers
Upper Keyb' Ref. → B5 A5 A#5 G#5 G5 F#5 C6 F5 E5 D#5 D5 C#5 C5
Lower Keyb' Ref. → B4 A4 A#4 G#4 G4 F#4 C5 F4 E4 D#4 D4 C#4 C4
GND
Octave Frequency Inputs

BOARD

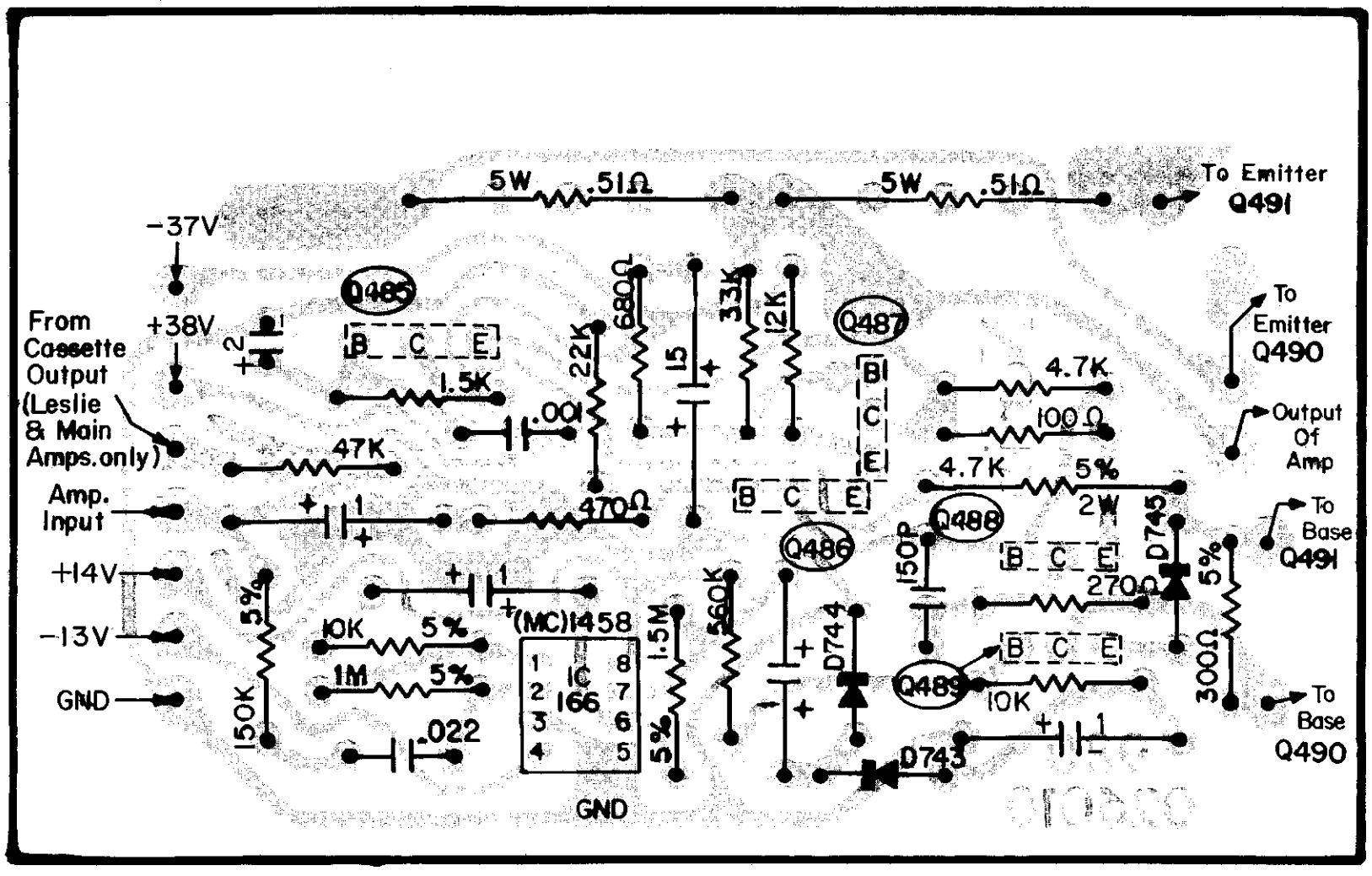
Like [J] No's Indicate On-Board Jumpers



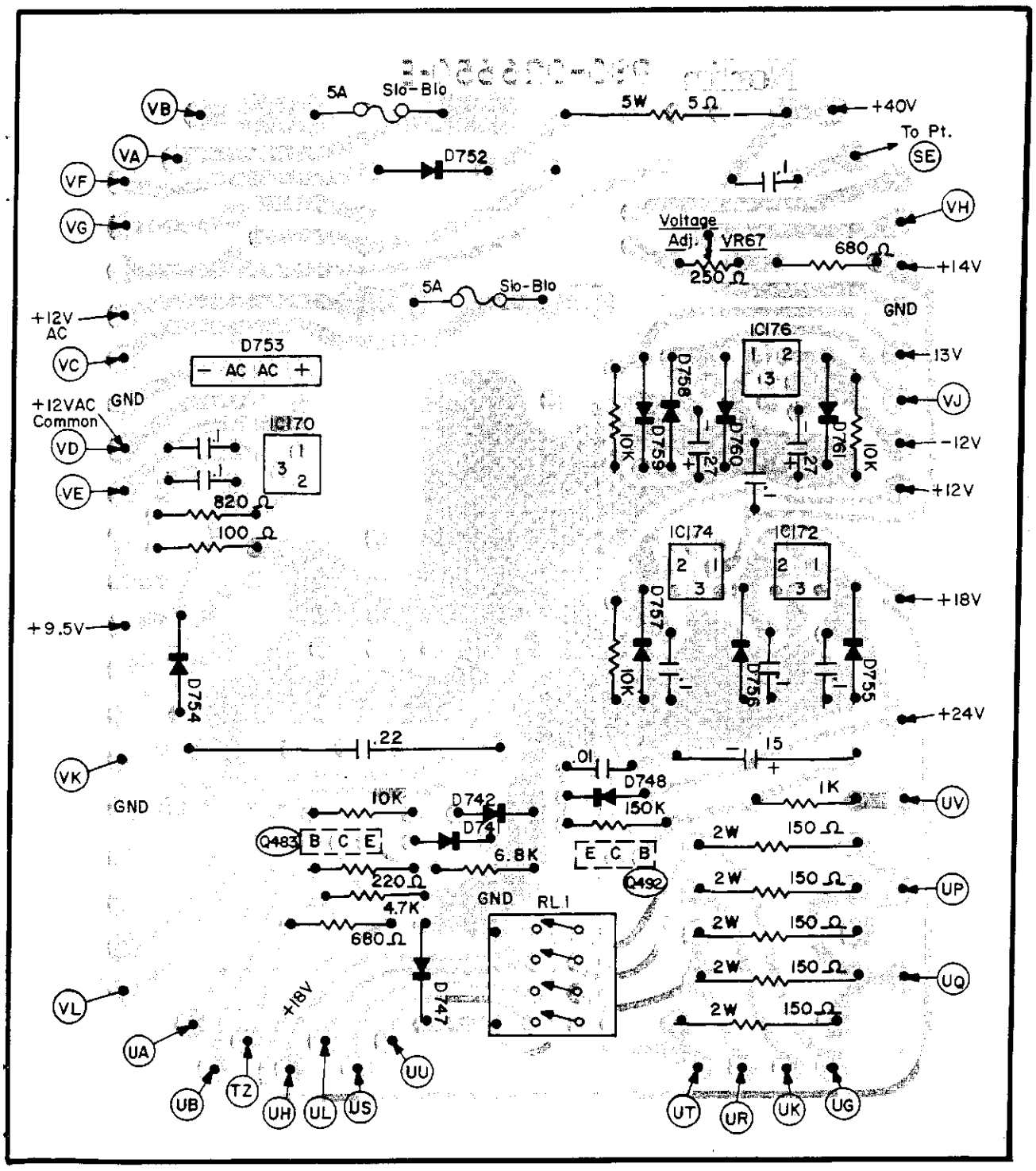
Upper Buffered Tone Generator Outputs

AMPLIFIER BOARD

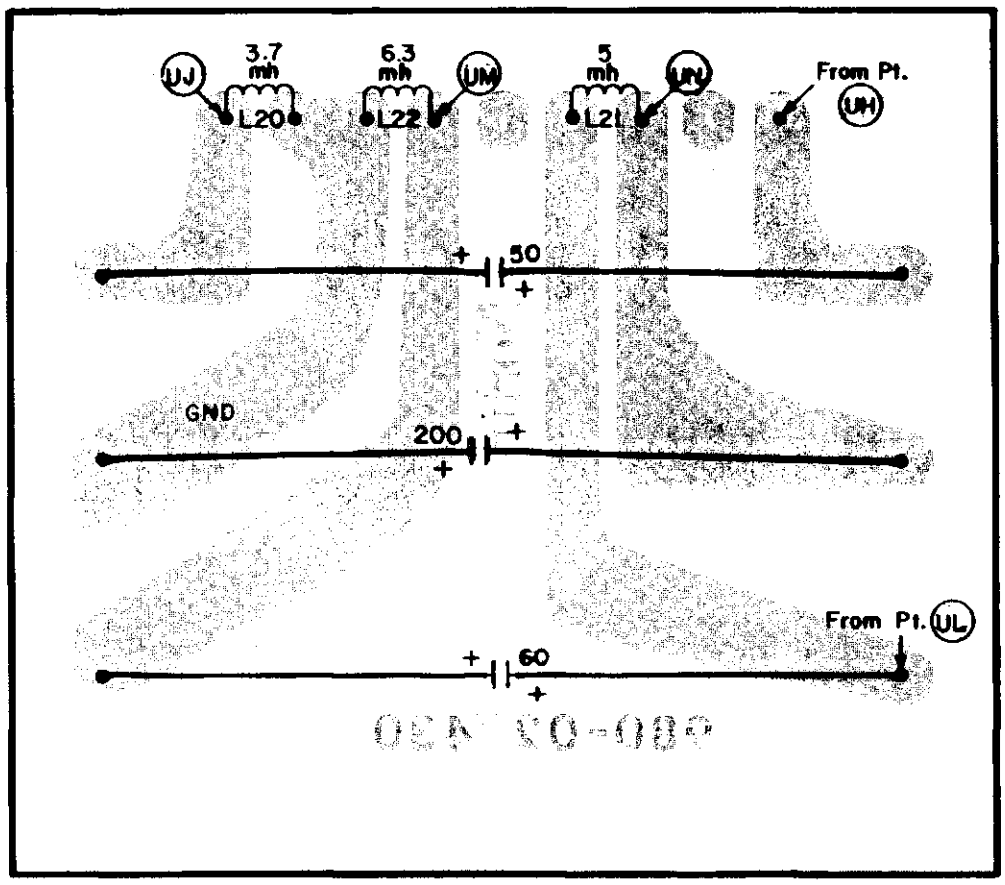
(1 Of 4 Typical Amps)



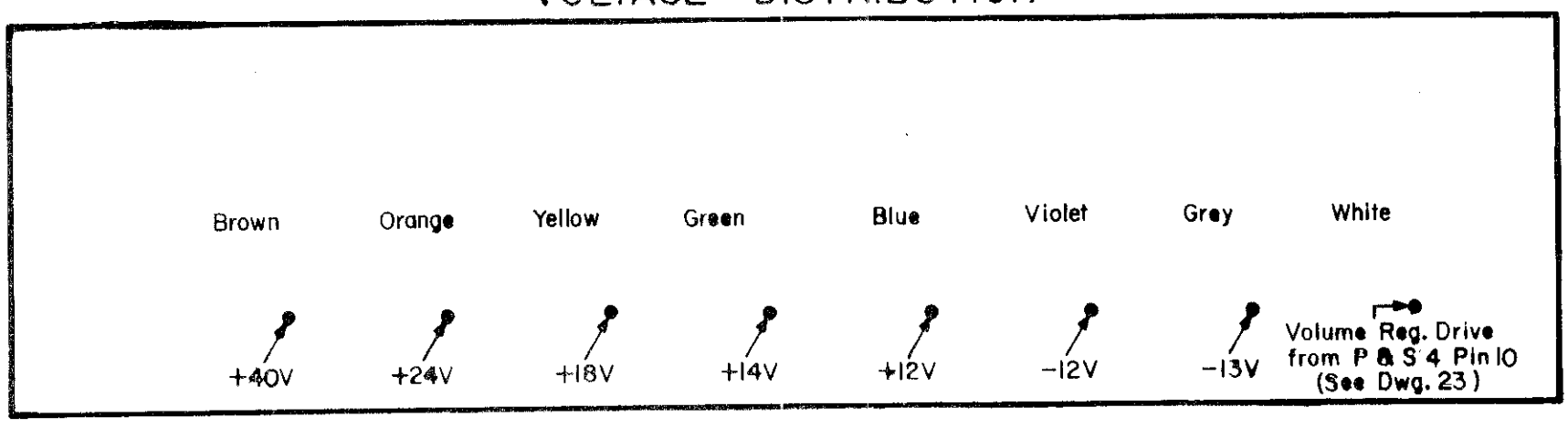
POWER SUPPLY BD.



CROSSOVER BOARD

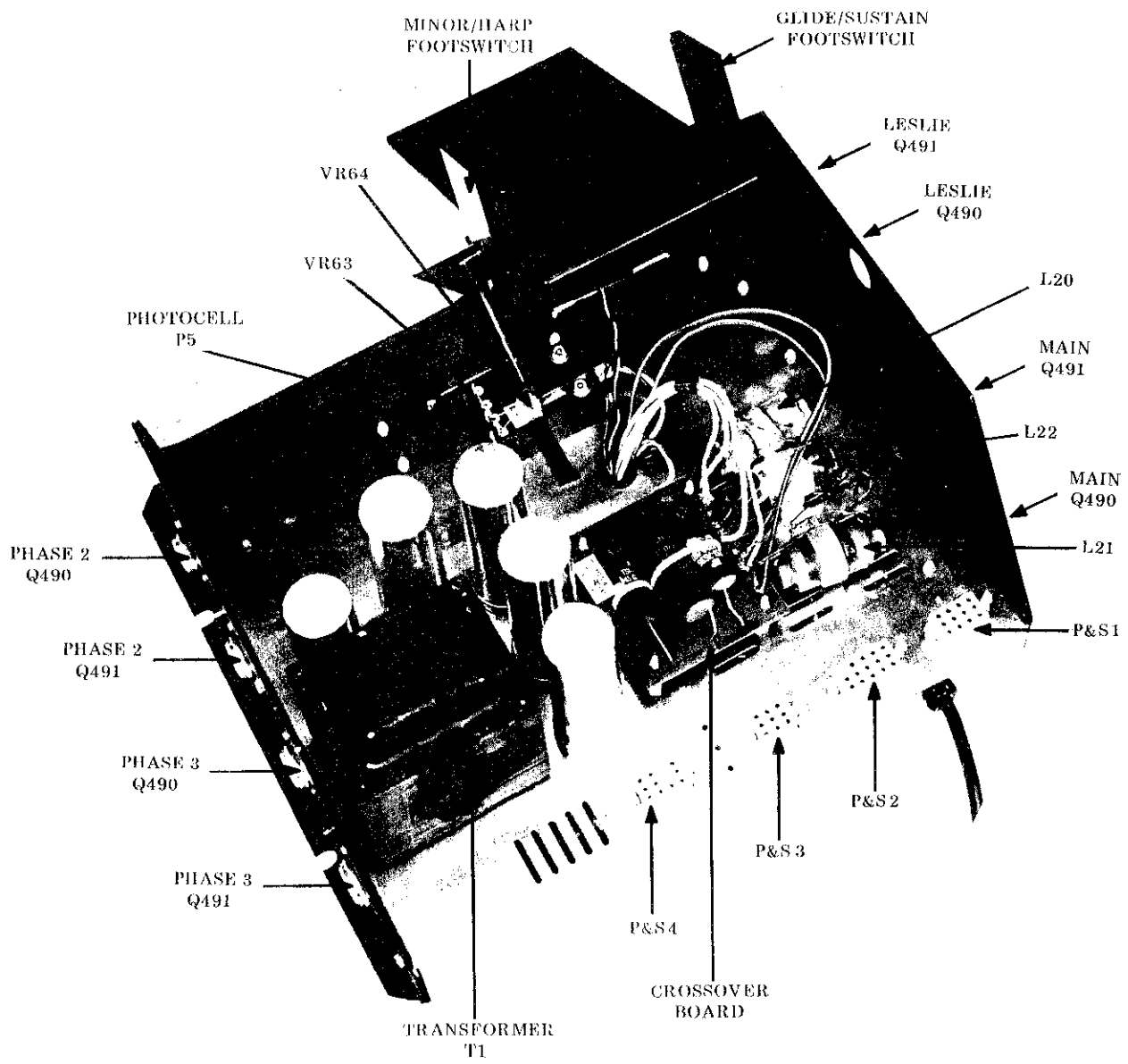


VOLTAGE DISTRIBUTION



AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY

[Top **View)**



AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY

(Bottom View)